Vol. 31, No. 8 October, 1934

THE
PSYCHOLOGICAL BULLETIN

FORTY YEARS OF PSYCHOLOGY

A Statistical Analysis of American and European Publications, 1894–1933

BY J. B. MALLER
Teachers College, Columbia University

It is said that science begins in philosophy and ends in art. This generalization applies in some degree to the science of psychology. It is neither necessary nor feasible to designate any year or period as the date of the separation of psychology from philosophy. It was gradual; it differed in different countries and in different phases of psychology. Psychological studies and investigations gained momentum during the last half-century with the introduction of experimental methods, and the establishment of psychological laboratories. At present, the application of psychological methods in the clinic or the classroom requires not only objective information but also some degree of artistic skill.

The historian might trace the trend of psychology by means of a chronological table (Flugel, 8) showing the major events in the development of the science. The danger of such a table, however, is that the selection of events depends to a large extent upon the historian's personal judgment and standard of values. The present study is an attempt at an objective survey of the trend in psychological studies during the last forty years.[1] The purpose was threefold: (1) to study the trend in the number of psychological publications; (2) to examine the trend in the different fields of psycho-

[1] The writer wishes to acknowledge his indebtedness to Dr. Otis W. Caldwell for valuable suggestions, to Miss Gloria Fernandez for faithful assistance, and to Dr. W. S. Hunter, editor of the *Psychological Index*, for making available the 1933 volume previous to its publication.

logical study; (3) to note the characteristics of psychological studies in American and European publications.

That the nature of psychological study differs somewhat in different countries is common observation. In fact, the difference, not only in method but also in results, is sometimes quoted as an indictment of the validity of psychological data. Thus, Bertrand Russell in his "An Outline of Philosophy" satirizes the differences in the findings of American and German psychologists in experiments on learning:

> "One may say broadly that all the animals that have been carefully observed have behaved so as to confirm the philosophy in which the observer believed before his observation began. Nay, more, they have all displayed the national characteristics of the observer. Animals studied by Americans rush about frantically, with an incredible display of hustle and pep, and at last achieve the desired result by chance. Animals observed by Germans sit still and think, and at last evolve the solution out of their inner consciousness." (22, p. 32.)

Another source of confusion is the prevailing notion in one country as to what constitutes the characteristic approach in another country. Vernon, discussing the German view of American psychology, states:

> "German psychologists have absorbed scarcely any of the literature that deals with developments in American research. They are still flogging the dead horse of Watsonian Behaviourism, and in the field of personality, their knowledge of American methods and theories rarely seem to extend beyond 1914." (24)

The present study is based chiefly upon the *Psychological Index*, which presents a comprehensive bibliography of studies in psychology. The *Index* has been published annually since 1894, edited by the late Professor Howard Carl Warren and a body of psychologists from various countries. It lists psychological studies in nearly all modern languages. The titles are classified into several divisions and subdivisions according to the phase of psychology with which each publication deals.

Other sources include Roback's *Bibliography of Character and Personality*, the *Psychological Abstracts*, and American and European psychological periodicals.[2]

The limitation of the source material of this study must not be overlooked. Comprehensive as the bibliography of the *Psychological Index* is, it includes only those titles which *reached* the editor and his

[2] Due to lack of space the present review will include only the findings based upon the *Psychological Index*.

associates. Furthermore, no matter how carefully the studies are classified, many of them are probably placed arbitrarily in one division rather than in another. This is true particularly of the publications in foreign languages. Nevertheless, the titles included represent the bulk of studies, and practically all of the more significant psychological publications. And though the classification is not infallible, it represents a reasonable, objective basis for determining the general trend, as well as the trend in various phases of psychological research. In order to reduce the effect of yearly fluctuations, comparisons are made in terms of four-year periods, for the years 1894–1933.

Before proceeding with the analysis of psychological studies listed in the *Psychological Index* for the years 1894–1933, inclusive, a few words should be said about the status of psychology at the beginning of this period. The *Psychological Index* was founded in the year 1894. At that time only two psychological periodicals were published, both founded and edited by G. Stanley Hall (*The American Journal of Psychology* and *The Pedagogical Seminary*). In 1892 the American Psychological Association was organized under the leadership of Hall, James, and Cattell. In that year two leading psychologists came to the United States, Titchener from England, and Münsterberg from Germany.

The original membership of the American Psychological Association included educators, physicians, and philosophers, as well as psychologists. The line of demarcation between philosophers and psychologists had just begun to be drawn. In 1895 a motion was placed before the American Psychological Association to form "a philosophical society or a philosophical section within the Association" and in the following year Witmer urged a plan for the formation of an American Philosophical or Metaphysical Association as one of the affiliated or associated organizations. According to Fernberger (5) "this motion had the function not of segregating the philosophers into a section of the Association, as was proposed the year before, but rather of lopping them off entirely from the Association".

The separation of psychology from philosophy is aptly summarized by Woodworth (26):

> "The influence of general biology and especially the theory of evolution from 1860 on, and the development of psychiatry raised new problems and led to the development of new methods of investigation, which tended to divorce psychology from its old union with philosophy and to align it with the natural sciences."

Again, discussing the status of psychology in the 90's, Woodworth says:

> "The psychologists of 1890–1900 were an active, aggressive group small in number, but rapidly recruiting itself from the younger generation, hopeful of its newly developed techniques of experiments and tests, beginning to study child, animal, and abnormal people as well as the standard adult, maintaining contacts with other sciences and much disposed to break away from philosophy."

The process of breaking away from philosophy was largely influenced by American psychologists. Indeed, the introduction of psychometric methods in psychology was considered by some as American in character. Vernon in his comparison between American and German approach to psychology states: "The cleavage in every branch of psychological research has been manifested ever since Cattell undertook the investigation of individual differences in reaction time in the Leipsig Laboratory, an experiment which Wundt called *ganz amerikanisch*" (**24**).

The growth of psychological publications. The total number of publications listed in the *Psychological Index* from 1894 to 1933 is 138,820, or 3,470 publications per year. The number increased consistently, though not regularly. Dividing the forty years into ten four-year periods, we note that the number increased from 7,405 in the first period (1894–1897) to 25,472 in the most recent period (1930–1933). With the exception of the war periods (1914–1917 and 1918–1921) the increase was continuous, at least as far as the four-year periods are concerned.

Of course, part of the increase may be due to an intensification of the editorial task of gathering information concerning psychological publications throughout the world. Nevertheless, if we consider the fact that the *Index* always had an international body of editors who endeavored to record all publications, it becomes obvious that the increase represents real growth in the number of psychological researches and their publications. It is consistent with Fernberger's finding in his survey of the publications of members of the American Psychological Association.

The variation from year to year is shown in Table 1, which gives the number of studies for each year from 1894 to 1933 inclusive:

TABLE 1

TABLE 1

PUBLICATIONS LISTED IN THE PSYCHOLOGICAL INDEX BY YEAR AND COUNTRY, 1894–1933

Year	American		British		French		German		Miscel.		Total
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.
1894....	493	37.5	70	5.3	252	19.2	295	22.4	202	15.6	1,312
1895....	469	33.6	34	2.4	318	22.2	484	34.7	89	6.5	1,394
1896....	721	32.2	43	1.9	456	20.4	561	25.1	453	20.4	2,234
1897....	708	28.7	74	3.0	677	27.4	415	17.0	591	23.9	2,465
1898....	677	26.4	72	3.0	599	23.4	270	10.5	940	36.7	2,558
1899....	648	25.0	54	2.0	729	28.6	576	22.2	577	22.2	2,584
1900....	640	24.5	57	2.1	842	32.0	552	21.0	536	20.4	2,627
1901....	594	19.8	85	2.8	979	33.0	651	21.8	676	22.6	2,985
1902....	710	27.0	67	2.5	732	27.8	651	24.7	468	18.0	2,628
1903....	719	34.0	49	2.3	482	22.7	423	19.9	449	21.1	2,122
1904....	761	22.0	31	0.9	672	19.5	1,213	38.2	768	22.2	3,445
1905....	598	22.0	42	1.5	480	17.6	986	36.2	621	22.7	2,727
1906....	948	30.4	68	2.1	575	18.2	1,333	42.3	221	7.0	3,145
1907....	745	24.8	62	2.0	527	17.5	1,404	46.8	259	8.9	2,997
1908....	952	27.0	86	2.4	621	17.6	1,505	42.6	361	10.4	3,525
1909....	896	29.2	73	2.3	656	21.4	1,168	38.1	281	9.0	3,074
1910....	960	30.2	53	1.6	438	13.8	1,651	52.0	68	2.4	3,170
1911....	837	26.1	67	2.1	448	13.9	1,518	47.4	348	10.5	3,218
1912....	850	23.0	48	1.3	412	11.1	2,077	56.2	305	8.4	3,692
1913....	708	25.8	85	3.1	366	13.3	672	24.5	909	33.3	2,740
1914....	921	34.8	67	2.5	352	13.3	1,147	43.4	155	6.0	2,642
1915....	1,468	55.7	83	3.1	242	9.1	614	23.3	227	8.8	2,634
1916....	1,561	64.9	99	4.0	120	4.9	515	21.2	124	5.0	2,419
1917....	2,039	76.7	101	4.0	225	8.4	85	3.1	208	7.8	2,658
1918....	1,060	66.8	52	3.2	65	4.1	220	13.8	188	12.1	1,585
1919....	1,408	60.4	46	1.9	265	11.3	154	6.5	468	19.9	2,341
1920....	1,479	49.7	265	8.9	176	5.9	699	23.5	351	12.0	2,970
1921....	1,389	57.1	131	5.3	286	12.0	446	18.3	178	7.3	2,430
1922....	1,865	45.7	47	1.1	317	7.7	1,256	31.0	592	14.5	4,077
1923....	1,870	51.1	120	3.2	322	9.0	465	12.7	878	24.0	3,655
1924....	1,588	40.7	157	4.0	285	7.3	1,438	37.0	433	11.0	3,901
1925....	1,935	45.9	136	3.2	386	9.4	900	21.3	853	20.2	4,210
1926....	1,973	35.6	197	3.5	379	6.8	1,298	23.4	1,690	30.7	5,537
1927....	2,000	34.5	219	3.7	500	8.7	1,496	15.8	1,583	37.3	5,798
1928....	2,144	40.0	231	4.2	330	6.0	1,678	30.7	1,074	19.1	5,457
1929....	2,207	34.5	225	3.5	336	5.2	2,152	33.6	1,472	23.2	6,392
1930....	2,270	34.5	331	5.0	400	6.0	2,505	38.1	1,064	16.4	6,570
1931....	2,267	33.5	350	5.1	554	8.1	2,596	38.2	1,025	15.1	6,792
1932....	2,446	41.9	299	5.1	465	7.9	1,030	17.6	1,584	27.5	5,824
1933....	3,261	52.0	233	3.7	459	7.3	880	13.9	1,453	23.1	6,286
Total	51,785	37.3	4,609	3.3	17,725	12.7	39,979	28.7	24,722	18.0	138,820

The table also presents the number of publications in English (American and British), French, and German. It will be seen that there is a marked yearly variation in the number of studies. Striking increases took place in the years 1896, 1904, 1922, 1926, and 1929. Marked decreases took place in the years 1903, 1905, 1913, 1918, 1932. The peak in the number of yearly publications was reached in 1931 with 6,792 titles. It declined in 1932 to 5,824, a decrease of 20 per cent. In 1933 the number of publications was 6,286, or 7 per cent less than in 1931. This decline would seem to be the result of the economic depression.[3] As will be shown later, however, the decline in the total number is due primarily to the striking decline in the number of German publications during the last two years (1932–1933).

The trend of psychological publications in different languages. Of the total number of psychological studies published during this period, 1894–1933, 40.6 per cent were written in English (37.3 per cent American and 3.3 per cent British publications); 12.7 per cent were published in French, and 28.7 per cent in German. The remaining 18.0 per cent were published in other languages.

An analysis of the publications by language and period reveals that the trend differed considerably in the different languages. This is given in Figure 1 which shows the trend of publications in two-year intervals. It reveals some interesting differences among the various languages with regard to the trend of publications during the last four decades. The trend of English publications (American and British combined) is that of a consistent increase. The German trend shows an increase up to 1914, a decrease to 1921 (the war period), and an increase up to the last period. During the years 1932–1933 the number of German studies decreased enormously. There were less German studies in the last two years than in the year 1931. The number of American publications increased during the last two years. The French trend shows some decline from 1898 to 1921; since then, a small rise.

The differences among the languages become even more striking when we consider the trend in the *proportion* of publications in the respective languages. The percentage of French publications declined throughout this period, from a leading position in 1898–1901 (with 29.3 per cent of the total), to third place (7.7 per cent) in the

[3] The fact that the decline in the number of publications set in about two years after the onset of the depression could be taken as the result of the lag between initiating a research (securing funds, etc.) and the publication of findings.

last four years. The German proportion, which was equal to the French (about 23 per cent each) in the years 1894–1897, increased to 46 per cent of the total in the four-year period preceding the World War (1910–1913). The percentage decreased during the war and the period following. It has since increased, but decreased markedly during the last two years.

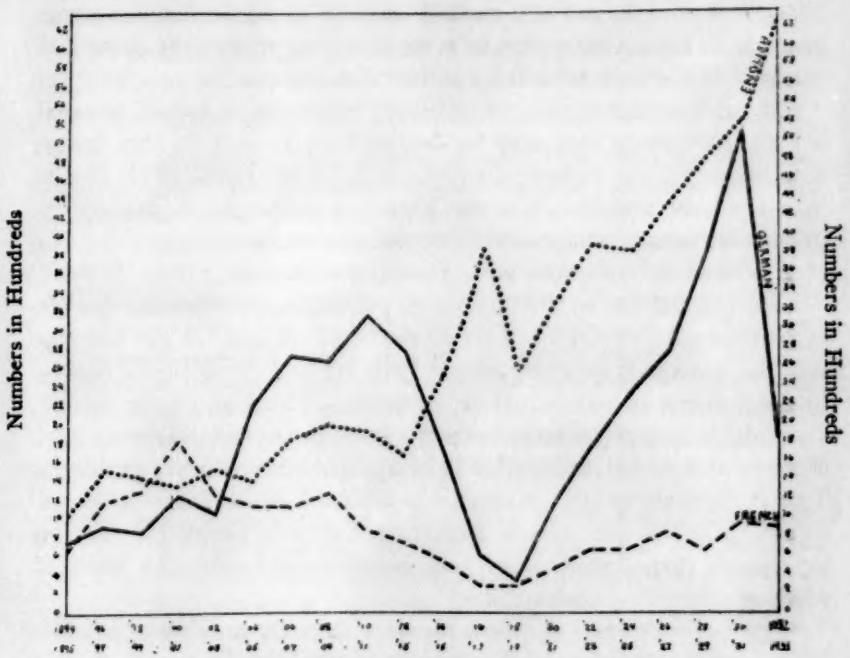

FIGURE 1

The Trend of Psychological Publications in English, French, and German

The percentage of publications in English has increased, reaching a particularly high proportion during the war, when foreign publications decreased in volume and in accessibility. Although the percentage decreased after the war, it still leads in proportion, and is definitely higher than in the years preceding the war.

In the first decade (1894–1903) the English publications constituted 30.4 per cent of the total, the French 26.4 per cent, and the German 23.7 per cent. In the pre-war period (1904–1913) these percentages were: English 26.6 per cent, French 16.3 per cent, and German 42.8 per cent. In the war and post-war period (1914–1923) the percentages were: English 58.6 per cent, French 8.6 per cent,

and German 20.4 per cent. In the last decade (1924–1933) the percentages were: English 43.1 per cent, French 7.2 per cent, and German 28.1 per cent.

Before conclusions are drawn from the trend in psychological studies, it should be remembered that the comparisons were based on the *number* of publications listed in the *Psychological Index*. No account was taken of the character of the respective publications. Thus, it is possible that the marked increase in publications in recent years is to some extent due to a tendency to present the results of research in the form of articles rather than books.

The differences among the different languages in regard to number of publications may also be due, at least in part, to this factor. It is likely that the American psychologist tends to publish his results in a series of articles while the French psychologist is inclined to publish his in one volume. This would account for the larger number of American as compared with French publications.

The general rise in the number of publications reveals the growth of psychological research. One of the chief reasons for the increase was the enormous interest, among both lay and professional people, in publications of psychological character. Members of the professions, including physicians, lawyers, journalists, and teachers, have come to look to psychology for light and guidance in their problems. This is particularly true of applied psychology which found its haven in the United States, and to some extent also in Germany. To the lay reader, too, "psychology was becoming the scientific basis of modern culture". (Adams, 2.)

Another fundamental reason for the rise in the number of psychological publications in the last decade is the increase in grants and funds given by foundations and institutions for the purpose of psychological investigations. Research problems have come to be investigated by institutes and departments rather than by isolated individual psychologists.

The latter factor resulted in an increased quantity of psychological studies, not always accompanied by an increase in quality of the work. As Laski (11) pointed out: "Coöperative Research is of high value once it has been determined to find a body of facts; it is of dubious value in determining what body of facts would be significant when found, and of still more dubious value in assigning values to them after their discovery. . . . Dangerous problems are not likely to be investigated, especially not by dangerous men; that would

not win the esteem of the trustees who can be counted upon to dislike disturbing themes. . . . There is an increasing drift away from the study of basic principles and toward the study of concrete facts."

Fields of interest in psychology. In the preceding sections only the number of psychological studies was considered. How are these studies divided according to the aspects of psychology with which they deal? What are trends in these respective fields and how do the publications of various languages differ in this respect?

The divisions and subdivisions of the *Psychological Index* were classified into ten major fields.[4] The total number of 138,820 titles classified into these ten fields gives the following distribution:

[4] The classification of titles in some sections of the *Index* has undergone several changes. The following sections remained practically unchanged throughout the period 1894–1933: *General, Nervous System, Sensation and Perception,* and *Feeling and Emotion.* The other groups were composed as follows:

Animal includes the subsection on *Comparative Psychology* 1894–1911; section on *Organic Evolution* 1911–1925; subsections on *Plants and Animals* 1925–1928; section on *Plant and Animal Psychology* 1929–1933.

Educational includes subsections on *Child and Pedagogy* and *Evolution and Heredity* 1894–1911; section on *Mental Development in Man* (excluding two subsections on *plants* and *animals*) 1911–1925; the above mentioned section on *Mental Development in Man* and also section on *Educational Psychology* 1925–1933.

Social includes subsections on *Anthropology, Criminology,* and *Sociology* 1894–1897; the above and the subsection on *Individual, Sex and Class Psychology* 1898–1900; the above and subsection on *Folk Psychology* 1900–1911; section on *Individual, Racial and Social Phenomena* 1911–1925; section on *Social Functions of Individual* 1925–1929; the above and section on *Industrial and Personnel Problems* 1929–1933.

Thought includes section on *Consciousness, Intellect, Attention* 1894–1900; sections on *Character of Consciousness* and *Cognition* 1900–1911; sections on *Attitudes and Intellectual Activities* and *Attention, Memory and Thought* 1911–1925; section on *Attention, Memory and Thought* 1925–1933.

Motor includes section on *Movement and Volition* 1894–1900; the above and section on *Higher Manifestations of the Mind* 1900–1911; section on *Motor and Volitional* 1911–1933.

Abnormal includes section on *Abnormal Psychology* 1894–1911; sections on *Special Mental Conditions* and *Nervous and Mental Disorders* 1911–1933.

The classification followed in this study differs somewhat from that used by Professor Goodenough in her *Trends of Psychology.* The present study had been practically completed when that excellent article appeared in the PSYCHOLOGICAL BULLETIN of February, this year.

Field	Number	Percentage
General	12,308	8.8
Animal	8,320	5.9
Educational	19,584	14.1
Social	20,973	15.1
Nervous System	10,094	7.2
Sensation, Perception	14,256	10.2
Thought and Memory	6,963	5.0
Feeling and Emotion	2,021	1.4
Motor and Volition	14,444	10.4
Abnormal	29,857	21.9
Total	138,820	100.0

The fields including the largest proportions of studies are those of *abnormal, social,* and *educational.* Next in order are those dealing with *sensation and perception* and with *motor and volition.* Lesser in frequency are the groups of *general, nervous system,* and *animal.* The least numbers are given to studies of *thought, memory and attention,* and those of *feeling and emotion.*

National differences in field of interest. Table 2 gives the number of studies by field of interest in American, British, French, and German publications. It will be seen that in the fields of *nervous system* and *sensation and perception,* the German studies exceed that of any other groups. In the other fields the American studies lead in numbers. This, however, is due largely to the fact that the total number of American titles is far in excess of the other groups. When we consider the proportion of studies within each group, some interesting differences appear. This is shown in Figure 2 on which the publications of different countries are compared with regard to the proportions of studies they are devoting to each field. Thus, of all American publications, 4.5 were devoted to studies of thought, etc.

It appears that American publications lead in the proportion of studies devoted to the fields of *animal* and *educational* psychology. They devote the lowest proportion to studies on the *nervous system,* and a low proportion to studies in *abnormal* psychology. British publications lead in the proportion devoted to the fields of *social* and *general* psychology. They are lowest in the fields of *thought, motor,* and *abnormal* psychology. German publications lead in the proportion given to *sensation* and devote a large proportion to studies on the *nervous system.* They give the lowest proportions to *animal, emotion, social,* and *general* psychology. French publications lead in the proportion of studies they devote to *emotion, thought, abnormal, motor,* and *nervous system.* They devote a relatively low proportion

TABLE 2

NUMBER OF PSYCHOLOGICAL PUBLICATIONS BY COUNTRY AND FIELD OF INTEREST

Field	American		British		French		German		Miscel.		Totals	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
General	5,164	10.0	583	12.6	1,327	7.4	2,950	7.3	2,284	9.2	12,308	8.8
Animal	4,446	8.5	227	5.0	1,044	5.8	1,690	4.2	913	3.6	8,320	5.9
Educational	9,102	17.5	433	9.3	901	5.1	5,056	12.6	4,092	16.5	19,584	14.1
Social	7,451	14.3	1,019	22.1	2,486	14.0	5,591	13.9	4,426	17.9	20,973	15.1
Nervous System	2,882	5.5	291	6.3	1,592	8.9	3,321	8.3	2,008	8.1	10,094	7.2
Thought	2,355	4.5	158	3.4	1,234	6.9	2,217	5.2	1,099	4.4	6,963	5.0
Emotion	802	1.5	62	1.3	466	2.6	468	1.1	223	.9	2,021	1.4
Sensation	4,650	8.9	591	13.0	1,681	10.0	5,750	14.9	1,584	6.4	14,256	10.2
Motor	5,245	10.1	378	8.2	2,389	13.4	4,086	10.2	2,346	9.4	14,444	10.4
Abnormal	9,688	19.2	867	18.8	4,605	25.9	8,950	22.3	5,747	23.6	29,857	21.9
Totals	51,785	100.0	4,609	100.0	17,725	100.0	39,979	100.0	24,722	100.0	138,820	100.0

TABLE 3

PSYCHOLOGICAL STUDIES BY PERIOD AND FIELD OF INTEREST

Numbers

Field	1894	1898	1902	1906	1910	1914	1918	1922	1926	1930
General	702	805	874	1,119	1,086	889	794	1,375	2,260	2,404
Animal	467	638	703	923	1,048	888	696	1,109	872	976
Educational	300	437	331	792	1,402	1,174	1,308	2,266	5,165	6,409
Social	825	927	800	1,016	1,921	1,824	1,703	2,973	4,246	4,738
Nervous System	1,010	1,811	1,306	1,125	841	834	465	713	954	1,035
Thought	876	1,240	893	807	712	395	342	415	660	623
Feeling	339	202	164	150	189	121	132	230	209	285
Sensation	588	922	1,688	1,664	1,734	953	1,065	1,871	1,819	1,952
Motor	477	1,493	2,362	2,899	1,196	681	619	1,300	1,691	1,726
Abnormal	1,821	2,279	1,801	2,246	2,691	2,594	2,202	3,591	5,308	5,324
Totals	7,405	10,754	10,922	12,741	12,820	10,353	9,326	15,843	23,184	25,472

Percentages

General	9.4	7.5	8.0	8.8	8.4	8.6	8.5	8.6	9.7	9.4
Animal	6.3	5.9	6.4	7.2	8.1	8.6	7.4	7.0	3.7	3.8
Educational	4.0	4.0	3.0	6.2	10.9	11.3	14.0	14.3	22.4	25.1
Social	11.1	8.6	7.3	8.0	15.3	17.9	18.2	19.0	18.3	18.6
Nervous System	13.6	17.0	11.9	8.8	6.5	8.0	4.9	4.5	4.1	4.0
Thought	12.0	11.5	8.1	6.3	5.5	3.8	3.6	2.6	2.8	2.4
Feeling	4.6	1.9	1.5	1.1	1.5	1.1	1.4	1.4	1.0	1.1
Sensation	8.0	8.6	15.4	13.0	13.5	9.2	11.4	11.8	7.8	7.7
Motor	6.4	13.9	22.0	23.0	9.3	6.5	6.6	8.2	7.2	7.0
Abnormal	24.6	21.1	16.4	17.6	21.0	25.0	24.0	22.6	23.0	20.9

to studies in *social* and *general,* and the lowest proportion to *educational* psychology.

It will be noted that the only field in which the French contributions equaled the German is that of *feeling and emotion.* In fact, the French contributed a larger percentage to this field than to any

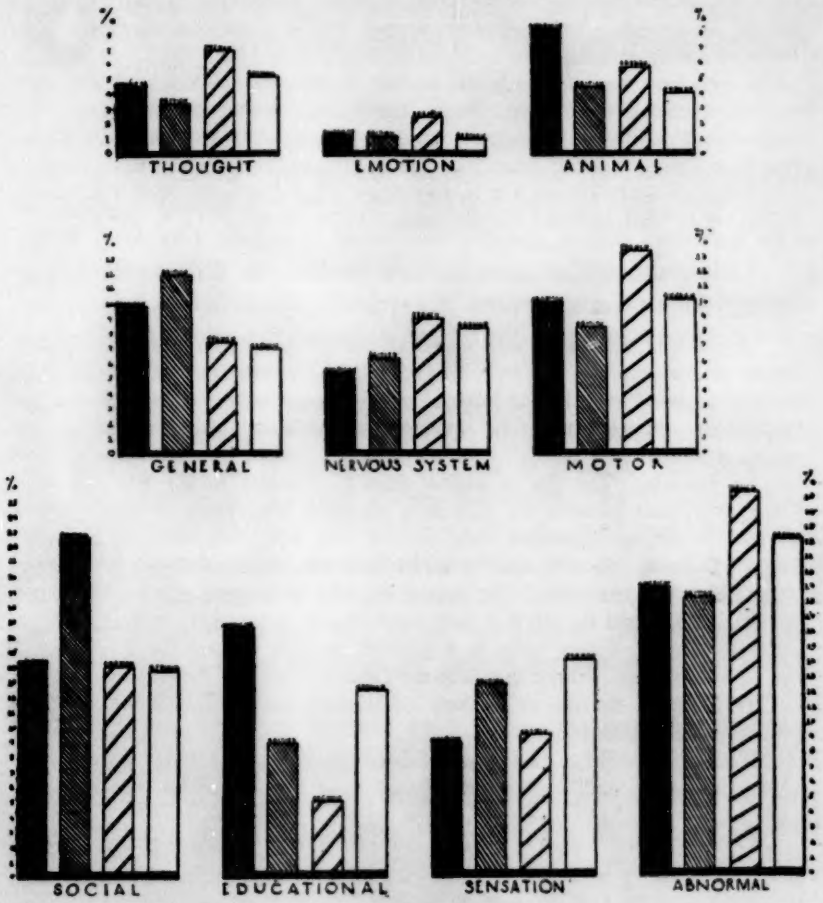

FIGURE 2

Percentage of Publications in Various Languages by Field of Interest

other, while the percentage of German studies in feeling and emotion is smaller than in any other field, except *animal psychology.* The Germans devoted the largest percentage to *sensation and perception* (40.7 per cent of total). The Americans devoted the largest percentage to *animal psychology* (52.8 per cent).

The above comparisons correspond to a large degree to the accepted views regarding the temper of psychology in the countries under consideration. Murphy in his *Historical Introduction to Experimental Psychology* states:

"French psychology has, for several generations, had its center in psychiatric conceptions, but has, in the work of Binet, contributed powerfully to the testing movement. The two foci around which American psychology has revolved are experimental methods and technique of testing. British psychology, while until very recently much less cordial to experimental research, has, since Galton, continued to make important contributions to statistical methods. The influence of Austria has been felt in the psychoanalytic movement. Switzerland, long renowned for education, has continued to do much for pedagogy. Chief Italian contributions are in neurology. Russian work upon the 'conditioned reflex' has leavened the psychology everywhere." (17, p. 407.)

Boring shares the same attitude toward the differences in psychology in various countries. He writes:

"American psychology was practical, for it dealt with life, the adaptive values of the mind for the organism against its environment. The Americans were relatively free from the internal personal conflict between philosophy and psychology. American psychology was never highly philosophized in any technical sense. . . . This practical approach would not have been possible but for Darwin. The rise of mental tests in America in the 90's and again when Binet had pointed the way is a concrete illustration of how Darwin affected Wundt on American soil.

"In Germany the laboratories which had already multiplied, settled down to a period of productivity. The connection with philosophy was never severed, but was emphasized by the fact that psychologists held chairs of philosophy at the universities. Today there is a general reaction against the elementarism and sensationism of Wundt in which the Gestalt school, at Berlin, leads.

"In England, the history of America repeated itself more slowly. Applied psychology is prospering.

"France is still primarily interested in abnormal and physiological psychology." (3, p. 657.)

The trend of interest in the various fields of psychology. If we take the number of publications in a given field as an index of interest, then the numbers for various periods reveal the trend of interest. Table 3 presents the number and percentage of publications by field of interest in each of the ten four-year periods. It reveals some interesting differences among the trends of the various fields. Studies in *general* psychology have remained practically constant in proportion throughout the four decades. The total range in the variation was only 1.9 per cent. A more detailed analysis of the subdivisions in this group indicates that the relative number of *general treatises*

and *collections* has decreased, while the number of books on *statistical methods* and *apparatus* has increased.

Studies in animal psychology showed a slight increase in proportion and then a marked decrease. It reached its height (8.6 per cent of total) at the beginning of the World War, 1914–1917. This peak was probably due to the contributions of Thorndike and others at that period. The proportion declined to 3.8 per cent during the recent period of 1930–1933.

A similarly curvilinear trend is shown by the proportions of studies devoted to *sensation and perception,* which increased up to 1902–1905 with 15.4 per cent of the total, partly due to the influence of German studies in this field, and then declined to 7.7 per cent in 1930–1933, and studies in *motor and volition,* which increased up to 1906–1909 with 23.0 per cent of the total, and then declined to 7.0 per cent in 1930–1933. The latter section has a subdivision on *instincts.* This topic included fully 18.9 per cent of the total in 1906–1909 and declined to 0.8 per cent in 1930–1933.

A marked decline is shown by studies dealing with the *nervous system* which decreased from 17.0 per cent of the total in 1898–1901 to 4.0 per cent in 1930–1933. Studies in *thought, attention and memory* suffered a consistent decline throughout the 40 years. This section included 12.0 per cent of the total in the first four-year period and 2.4 per cent in the most recent period.[5] One of the subdivisions in that section, studies of *consciousness* declined from 5.1 per cent in the first period to 1.8 per cent in the last period. Studies in *feeling and emotion* decreased from 4.6 per cent in the first period to 1.1 per cent in the last period.

Only two fields of interest have shown a consistent increase. Studies in *social psychology* which included 7.3 per cent in 1902–1905 rose to 18.6 per cent in 1930–1933. Even more striking was the rise in the proportion of studies devoted to educational psychology.[6] It increased consistently from 4.0 per cent in 1894–1897 to fully 25.1 per cent of the total in 1930–1933.

[5] Goodenough (9) has shown that there was a decrease in the number of philosophical articles, those containing in the title the word *philosophy, philosopher* or such definitely *philosophical* terms as positivism, monism, metaphysics, epistomology, etc. The percentage of such articles was 6.9 per cent in 1900, 5.6 per cent in 1910, 1.0 per cent in 1920, 0.7 per cent in 1930.

[6] *Mental tests* included under *Educational Psychology* had relatively few titles before 1908. It increased markedly up to 1922, and then decreased. *Childhood* and *Adolescence,* another subdivision, remained practically constant in proportion during 1894–1914. It declined during the war period and increased

Studies in *abnormal psychology,* which as a group include more than one-fifth of all publications, show considerable variation. It began in 1894–1897 with a high proportion, 24.6 per cent, partly due to the contributions of French psychologists of that period. It then declined to 14.6 per cent in 1902–1905, then increased again to 25 per cent in the war period, 1914–1917. Since then it showed a slight decline. During the recent period 1930–1933 it included 20.9 per cent, falling below the proportion devoted to educational psychology. Further analysis revealed that the subdivisions on *insanity* and on *disorders of sensation* and *perception* have decreased, while the subdivision on *hysteria, hypnotism,* and *suggestion* showed an increase.

The above trends are shown graphically in Figure 3 which pre-

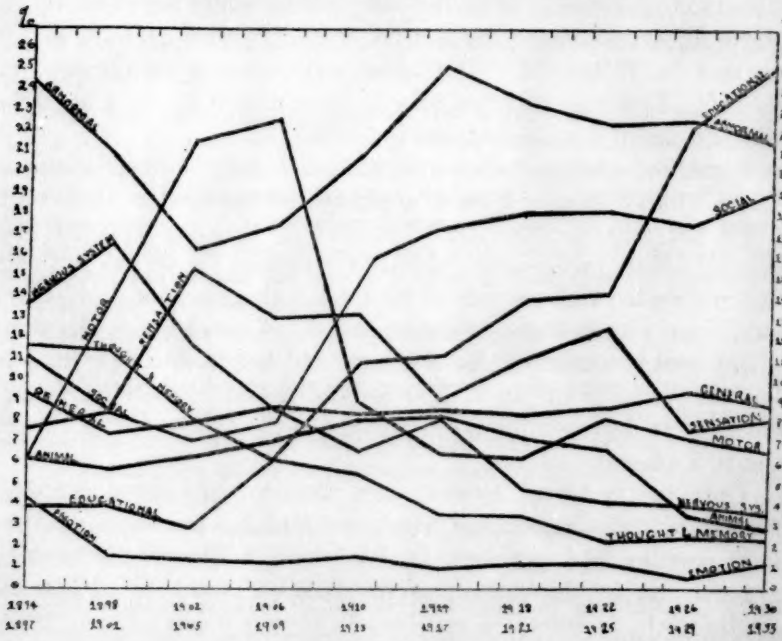

FIGURE 3
Psychological Publications by Field of Interest, 1894–1933

sents for each period the percentage of studies devoted to each of the major fields of psychology.

National differences in trends of interest. The number and pro-

again up to the present. *Industrial and Personnel Problems* began as a group in 1910. It increased rapidly up to 1930, but declined in the recent period. Articles on psychoanalysis have decreased since 1925 and articles on behaviorism have decreased since 1928.

portion of publications by period and field of interest were obtained for American, British, French, and German publications. The results are shown in Table 4 and Figure 4. The percentages are in terms of the total number of articles of each country.

TABLE 4

TREND IN PSYCHOLOGICAL STUDIES BY PERIOD AND FIELD OF INTEREST

	Field	1894	1898	1902	1906	1910	1914	1918	1922	1926	1930
American	General	238	206	273	322	301	592	510	609	900	1,208
	Animal	210	237	234	348	695	650	434	576	568	504
	Educational	198	199	161	332	218	851	1,046	1,379	2,111	2,607
	Social	233	278	248	287	483	1,018	1,041	1,410	778	1,463
	Nervous System	221	298	283	286	161	390	159	255	364	415
	Thought	316	333	236	278	184	205	133	154	253	263
	Feeling	103	34	35	43	44	66	59	109	156	153
	Sensation	189	194	319	376	297	441	467	752	833	992
	Motor	166	325	621	696	319	382	398	584	844	1,116
	Abnormal	517	455	378	573	653	1,394	1,106	1,430	1,517	1,725
British	General	33	30	25	38	74	30	47	53	123	130
	Animal	19	21	15	19	18	8	17	17	22	71
	Educational	10	18	9	20	17	30	42	36	93	158
	Social	32	17	10	47	27	67	151	55	197	446
	Nervous System	30	41	22	30	14	39	26	16	31	42
	Thought	15	22	16	14	8	10	13	18	22	20
	Feeling	7	1	1	1	1	3	14	11	17	6
	Sensation	10	17	36	34	36	75	54	81	124	124
	Motor	15	57	38	53	17	21	26	45	69	37
	Abnormal	50	44	17	33	41	67	104	128	174	209
French	General	139	180	140	202	124	84	72	144	146	96
	Animal	75	190	121	65	83	55	77	131	106	141
	Educational	35	85	42	24	93	34	50	105	130	303
	Social	220	307	253	358	319	181	120	169	303	287
	Nervous System	226	518	244	132	79	72	56	81	115	69
	Thought	210	249	266	158	107	42	26	44	77	55
	Feeling	91	72	65	57	45	22	24	21	32	37
	Sensation	93	285	285	216	152	71	107	152	133	207
	Motor	111	440	519	590	169	91	91	130	123	125
	Abnormal	494	823	431	577	503	287	169	333	410	578
German	General	181	163	239	439	415	140	58	279	479	557
	Animal	78	64	101	302	290	302	63	177	166	147
	Educational	59	69	145	381	551	116	79	406	1,567	1,683
	Social	101	105	165	340	1,085	318	135	597	1,350	1,395
	Nervous System	348	416	406	612	474	262	126	263	175	239
	Thought	208	277	269	320	329	96	48	153	222	195
	Feeling	79	24	38	36	76	21	14	52	74	54
	Sensation	181	228	668	1,072	1,038	310	352	738	547	626
	Motor	103	324	664	1,115	560	155	132	413	332	288
	Abnormal	417	379	578	793	1,100	641	512	981	1,712	1,827

The most striking aspect of this comparison is the general consistency of the trends. Thus we note that studies in *Thought, Attention and Memory* declined consistently in all national groups. Furthermore, the national differences in this respect are decreasing. In the initial period the Americans devoted 13.2 per cent of their publi-

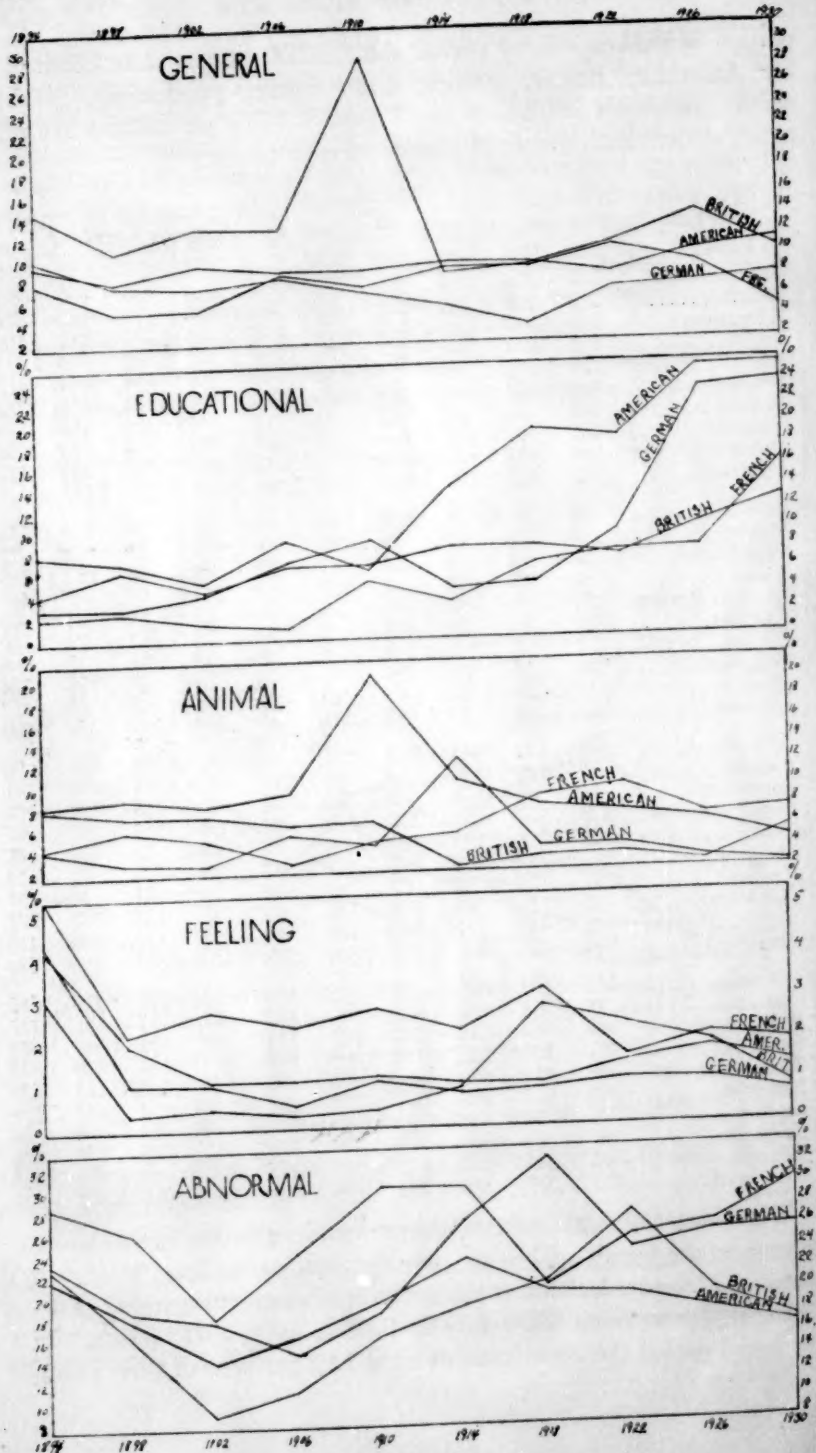
GENERAL
BRITISH
AMERICAN
GERMAN
EDUCATIONAL
AMERICAN
GERMAN
BRITISH
FRENCH
ANIMAL
FRENCH
AMERICAN
BRITISH
GERMAN
FEELING
FRENCH
AMER.
BRIT.
GERMAN
ABNORMAL
FRENCH
GERMAN
BRITISH
AMERICAN

FIGURE 4

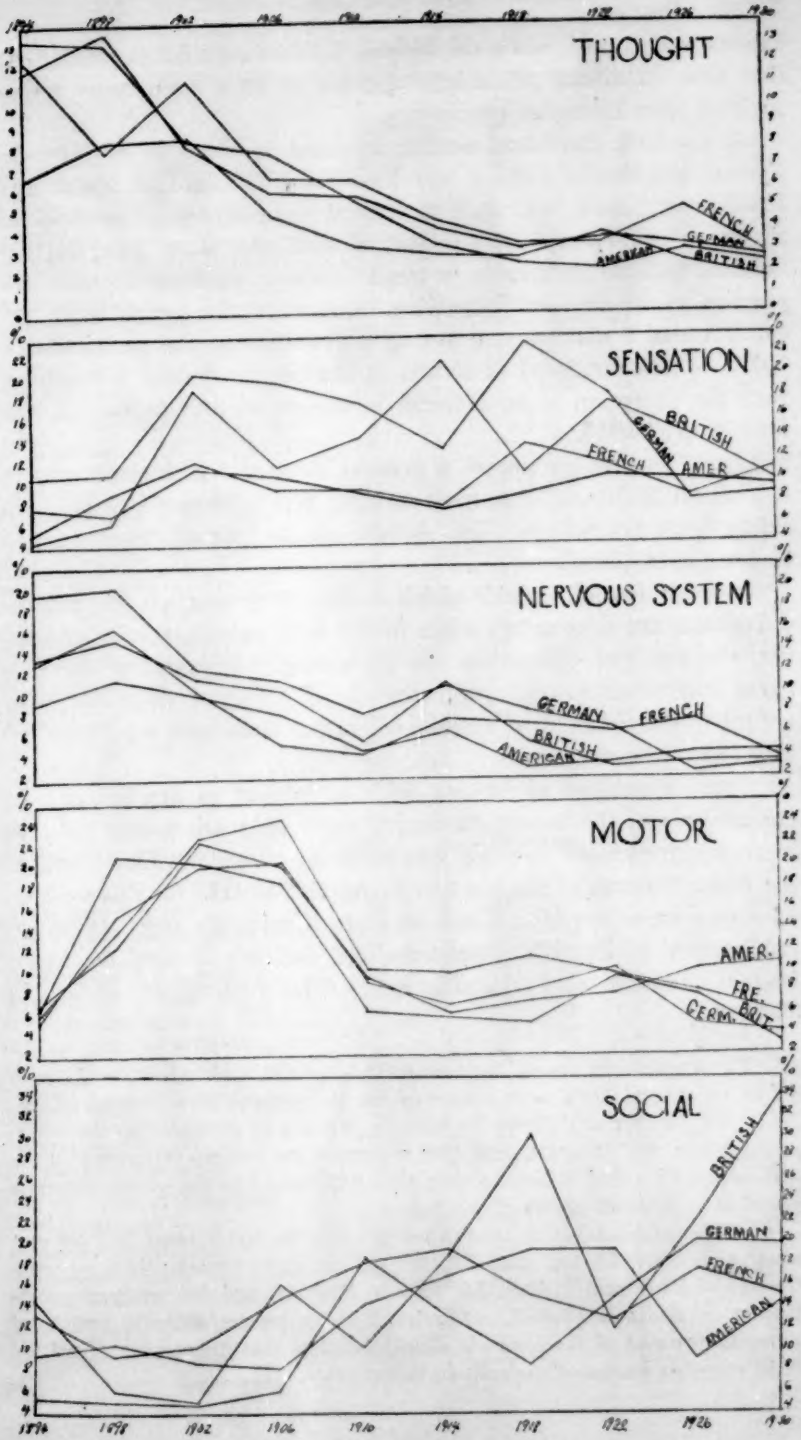

FIGURE 4 *(Continued)*

cations to this field, while the British devoted only 6.7 per cent. At that time American psychology appears to have been more philosophical than European psychology.

A similarly consistent decline is noted in the field of *Nervous System* and that of *Feeling and Emotion*. The field of *Motor and Volition* increased, and then decreased consistently. The field of *Sensation and Perception*, and that of *Abnormal* show some fluctuation and national differences in trend. *General* publications remained practically constant in proportion throughout the period with the exception of a marked rise among the British in the period 1910–1913. A similar trend is shown in studies in *Animal* psychology, with the exception of an increase in American publications in that field in 1910–1913.

Social psychology shows a general increase, particularly among British publications. The most striking rise is shown in studies in *Educational psychology*. This is particularly true of American and German publications.

It seems that in the fields which declined in proportion the national differences are decreasing, while in the fields which rose in proportion the national differences are increasing. Apparently, there is more agreement among psychologists of different countries with regard to the fields to be abandoned, rather than with regard to the new ones to be explored.[7]

Detailed analysis of current fields of interest in psychology. In the analysis of the trends the major fields only are considered. A more comprehensive analysis was made of all publications listed in the *Index* volumes of the last five years, 1929–1933. In this analysis 72 topics were considered and separate tabulations were made for publications in English (American and British), French, German, Italian, Russian, and Miscellaneous. The results are shown in Table 5.[8]

[7] The correlations among the four national groups with regard to the rank orders of the ten fields were computed for the periods 1894–1897, and 1930–1933. The average correlation for the first period was .69 while for the recent period it was .90. It seems, then, that in general the national differences in the various countries tend to become more alike with regard to the relative emphasis placed upon different phases of psychology.

[8] Of the total number of articles published in the last 5 years 39.6 per cent were American; 4.4 per cent British; 6.9 per cent French; 29.6 per cent German; 5.3 per cent Italian; 5.6 per cent Russian; and 8.6 per cent miscellaneous. Articles in Spanish, not included in the present analysis, constituted about 1.5 per cent of the total. It should be noted that the number of articles in Russian has increased markedly in recent years.

TABLE 5

PUBLICATIONS BY TOPIC AND LANGUAGE, 1929–1933

	American	British	French	German	Italian	Russian	Misc.	Totals
I—General								
1. Textbooks	144	46	13	67	10	18	17	315
2. History	161	21	26	100	56	33	63	460
3. Relations	95	21	21	43	26	2	1	209
4. General Problems	271	30	28	185	47	37	74	672
5. Mind, body	21	0	5	30	7	3	4	70
6. General methods	70	4	10	20	11	8	5	128
7. Statistical	268	24	3	21	5	7	16	346
8. Apparatus	276	15	14	35	12	16	34	402
9. Collection	154	3	7	156	12	8	33	373
II—Nervous								
10. Discussion	65	11	9	40	7	27	9	168
11. Elementary structure	18	2	3	4	8	6	2	43
12. Nerves	142	9	32	65	16	21	12	297
13. Spinal cord	81	7	15	39	13	9	6	170
14. Cerebellum	23	3	9	20	9	2	4	70
15. Cerebrum	126	2	21	96	20	34	57	356
16. Pathology	85	17	14	39	46	16	31	248
III—Sensation								
17. Receptor organs	30	5	15	38	2	3	8	101
18. Somesthesia	107	7	45	79	16	4	12	270
19. Audition	94	39	21	93	10	3	9	269
20. Vision	409	92	69	284	34	14	135	1,037
21. Perception	180	11	34	181	25	8	15	454
22. Psychophysics	52	1	2	13	8	0	12	88
23. Disorders	76	15	30	72	21	3	18	235
IV—Feeling								
24. General affection	75	3	12	25	9	2	1	127
25. Emotion, sentiment	117	6	32	46	7	3	13	224
V—Motor								
26. General reaction	48	1	10	27	11	17	23	137
27. Muscles and glands	227	19	21	55	30	12	165	529
28. Reflexes	171	10	57	65	34	100	66	503
29. Autonomic functions	70	1	9	49	12	4	7	152
30. Instinct, impulse	29	6	8	21	7	0	4	75
31. Voluntary action	38	1	13	57	11	0	25	145
32. Learning, adjustment	189	9	15	33	14	11	115	386
33. Work, fatigue	85	3	20	80	33	47	18	286
VI—Attention, Thought, etc.								
34. Attention, interest	33	1	10	17	8	9	8	86
35. Memory, imagin., assoc.	190	16	41	141	14	19	42	463
36. Thought, judgment	86	5	35	115	3	9	24	277
VII—Social Functions								
37. General self	243	19	26	108	23	19	197	635
38. Lang., writ., read	305	21	65	375	27	32	20	845
39. Aesthetics	201	27	36	163	21	5	29	482
40. Conduct, morals	98	10	16	71	20	5	11	231
41. Custom, religion	135	57	28	204	12	5	146	587
42. Sex behavior	161	14	15	155	11	5	8	369
43. Racial anthropology	290	59	41	97	23	7	61	578
44. Criminology, degeneracy	201	24	40	310	72	13	87	747

TABLE 5—*Continued*

	American	British	French	German	Italian	Russian	Misc.	Totals
VIII—Industrial and Personnel Problems								
45. General	150	53	25	155	52	74	21	532
46. Industrial efficiency	58	61	20	129	31	64	21	384
47. Personnel problems	222	47	35	138	25	83	0	550
48. Advertising, selling	38	18	0	32	3	5	0	96
IX—Special Mental Conditions								
49. Psychoanalysis	193	30	99	685	15	5	69	1,096
50. Suggestion, hypnosis	61	7	17	59	1	12	13	170
51. Sleep, dreams, narcoses	106	19	36	176	23	13	1	374
52. Unconscious	6	8	15	32	3	0	7	71
53. Psychical research	183	8	12	259	9	0	0	471
X—Nervous, Mental Disorders								
54. General psychiatry	576	82	134	388	115	148	107	1,550
55. Maldevelopments	131	22	6	48	17	19	123	363
56. Anaesthesias, aphasias, etc.	22	5	18	42	14	3	15	119
57. Epilepsy, chorea, etc.	132	13	7	53	35	20	29	289
58. Hysteria, neurasth., etc.	117	20	107	135	23	36	34	472
59. Dementia praecox	96	8	47	121	48	24	52	396
60. Manic-depressive	33	3	18	41	10	5	12	122
61. Organic toxic condit.	282	26	113	215	104	85	126	951
62. Medical jurisprudence	31	1	16	44	29	3	22	146
XI—Mental Development in Man								
63. Evolution, heredity	360	42	24	174	18	16	31	665
64. Mental tests	358	23	50	36	12	89	38	606
65. Individual psychology	495	35	94	470	30	79	62	1,265
66. Child., adolesc., delinq.	885	60	87	822	63	216	340	2,473
XII—Educational								
67. General problems	410	28	17	409	43	39	128	1,074
68. Tests, measurements	422	11	18	61	3	39	128	682
69. Vocational guidance	141	13	27	98	23	51	52	405
70. Instruction, curriculum	386	15	18	192	11	18	96	736
XIII—Plants, Animals								
71. Plants	9	7	12	13	1	1	0	43
72. Animal behavior	608	64	146	200	21	37	42	1,118
Totals	12,451	1,438	2,214	9,163	1,605	1,790	3,203	31,864

Of the 72 topics, those five with the highest number of articles include studies in *childhood, adolescence, delinquency; general psychiatry; individual psychology; animal behavior;* and *general problems of education.*

A number of interesting national differences in emphasis are revealed. First, let us consider the dominant topics. The four topics to which Americans devote the largest number of publications include studies in *childhood, adolescence* and *delinquency; animal behavior; general problems of education;* and *general psychiatry.* The four

topics with the smallest number are: *unconscious; mind; structure of nerves; plants.*

In British publications the four leading topics are: *Industrial efficiency; general psychiatry; vision;* and *animal behavior.* Those of least emphasis include: *mind; autonomic functions; voluntary action;* and *medical jurisprudence.*

In French the leading topics are: *general psychiatry; hysteria* and *neurasthenia; organic toxic conditions; animal behavior.* The topics of least emphasis are: *advertising and selling; statistical methods; elementary structure of nerves; psychophysics.*

In German publications the leading topics are: *psychoanalysis; general psychiatry; childhood, adolescence* and *delinquency; general problems of education.* The topics with the smallest numbers are: *psychophysics; plants; elementary structure of nerves; attention and interest.*

In Italian publications the leading topics are: *general psychiatry; organic toxic conditions; history of psychology, criminology and degeneracy.* The topics of least emphasis are: *suggestion and hypnosis; plants; receptor organs; tests and measurement.*

In Russian publications the leading topics are: *reflexes; industrial and personnel problems; childhood adolescence* and *delinquency; general psychiatry.* Those topics on which no Russian studies are mentioned are: *psychophysics; instinct and impulse; voluntary action; unconscious; psychical research.*

The comparison of leading topics reveals some degree of similarity of interest. Thus, studies in *general psychiatry* are among the leading five topics in each of the countries under consideration. It is of interest to note the topics to which the respective countries contribute the largest or the smallest proportions. This reveals the relative emphasis given to a topic in one country as compared with other countries. American publications are particularly dominant in the topics dealing with *statistical methods* (77.4 per cent), *apparatus* (68 per cent), *tests and measurements* (62 per cent).[9] They also contribute a very large proportion, more than 50 per cent, to studies in *feeling and emotion, mental tests, instruction* and the *curriculum, heredity and evolution, psychophysics,* and *animal behavior.*

The British contributed 18 per cent of the studies in *advertising and selling,* which is larger than their percentage in any other topic.

[9] Lehman and Witty in a study of 204 recent American doctoral dissertations found that fully 65 per cent employed statistical methods while only 24 per cent made use of literature in any foreign language (12).

They also contributed a larger number of studies than did the Americans to *industrial efficiency.*

The French contributed a relatively large percentage to studies in *abnormal psychology—hysteria and neurasthenia* (23 per cent), and *unconscious* (21 per cent). Other topics of interest include studies on the *nervous system, memory,* and *emotion.*

The topic with the largest proportion of German studies is *psychoanalysis.* More than 60 per cent of all publications dealing with this subject are printed in German.[10] Other prominent topics are *psychical research* (55 per cent), *sleep, dreams and narcoses* (47 per cent), *unconscious* (45 per cent), *mind and body* (43 per cent).

Among Italian publications the topics with highest percentages of the respective totals include studies on the *nervous system; cerebrum* and *spinal cord;* and *medical jurisprudence.*

Russian publications contribute a large percentage to studies on *reflexes, industrial efficiency,* and *personnel problems.*

The American Approach. The present review seems to indicate that in America, and in other English-speaking countries, though the general interest in psychology is catholic, the chief interest lies in applied psychology, with emphasis on the experimental and statistical methods of approach and a tendency to base researches on large numbers of cases. In France, the chief interest lies in the study of abnormal and affective psychology. Among the German psychologists, with their marked interest in characterology, typology, gestalt, and psychoanalysis, the emphasis is placed upon qualitative psychology based upon intensive case studies.

In the evaluation of the so-called American approach to psychology there are two major considerations: the statistical approach, usually based on mass measurements, versus the analytical approach, usually based on case studies, and the practical versus the theoretical type of problem to be investigated. Now, the fact that an observation is based on a very small number of cases does not indicate that the observation was done with utmost care, and conversely, an observation based on a very large number of cases is not necessarily done without care. The organized and efficient facilities at the dis-

[10] It is interesting in this connection to compare the German and Russian attention to this subject. While 685 German studies on psychoanalysis are listed for 1929–1933, there are only 5 Russian studies. The number of German studies in psychoanalysis is more than twice the combined number of studies in English, French, Italian, and Russian.

posal of the American psychologist and the application of psychological methods to the needs of crowded schools, clinics, and guidance bureaus make large scale measurement and research not only feasible, but actually imperative. In America, and to an increasing degree in other countries, the tendency is toward research on a large scale. Organized research under the auspices of an academic institution or some government agency is often preferable to independent individual research. Whether we like it or not, scientific production follows the same laws as industrial production. The frequent application of statistical methods to psychological and educational research in America is as inevitable a result of social and economic conditions as are American methods in commerce and industry.

It is true that the statistical approach has its limitations, particularly when used indiscriminately, or without understanding of the assumptions underlying given formulae. Correlation coefficients are to be used, according to Keynes, "to confirm conclusions at which one has arrived on other grounds". Thurstone, in a comparison between the relative merits of the statistical and the non-statistical methods of approach states: "The correlational methods have probably stifled scientific imagination as often as they have been of service. As tools in their proper place they are useful, but as the central theme of mental measurement they are rather sterile. On the other hand, I should never recommend the loose thinking that is current in some European psychology where biometric logic is conspicuous by its absence. What is needed there is more of the biometric methods of testing clever ideas." (23)

The tendency to limit research to practical problems is associated with the essential American characteristic, that of pragmatism. People are studied for the purpose of increasing their personal happiness or their social usefulness (making them more satisfied or more satisfying). Studying people without the above purpose in mind appears to the American not only as useless but as something in the nature of morbid curiosity.

Summary

1. The volumes of the *Psychological Index,* 1894–1933, list 138,820 titles of studies. Of these 40.6 per cent were in English, 12.7 per cent in French, 28.7 per cent in German, and 18 per cent in other languages.

2. The number of studies shows a general increase in all languages

with a decrease during the World War period. German studies declined in the last two years, 1932–1933.

3. More than one-half of all studies are in the fields of *abnormal, social,* and *educational psychology.*

4. The fields of psychology to which the Americans contribute the largest proportions are *animal behavior,* and *educational psychology.* They seem to be least interested in studies of *abnormal,* and *physiological psychology.* The British contribute more to *social psychology* than to any other field. The Germans devote the largest percentage to the study of *sensation, nervous system,* and *abnormal.* They are least interested in *animal behavior.* The French contribute more to studies in *emotion* than to any other field. They contribute least to *educational psychology.*

5. The fields of *thought* and *emotion* are declining in numbers while the fields of *social* and *educational psychology* are rising.

6. There is considerable likeness among the various countries under consideration with regard to the trend in most of the fields of psychology. In some fields, however, there are marked national differences in trend.

Our statistical analysis seems to support the general view of the growth of psychology which has been humorously summarized in the statement that psychology first lost its soul, then its mind, then its consciousness, but it still behaves.

BIBLIOGRAPHY

1. Adams, G., *Psychology, Science or Superstition.* New York: Covici, Friede, Publishers, 1931, 299 pp.
2. Adams, G., Rise and Fall of Psychology. *Atlantic Month.,* Jan., 1934, pp. 82–92.
3. Boring, E. G., *History of Experimental Psychology.* Century Psychology Series, R. M. Elliot (Ed.), 1929, 699 pp.
4. Fernberger, S. W., Publications of American Psychologists. *Psychol. Rev.,* 1930, pp. 526–544.
5. Fernberger, S. W., American Psychological Association, Historical Summary. *Psychol. Bull.,* 1932, pp. 1–82.
6. Ford, A., *Story of Scientific Psychology.* Sears Publishing Co., 1932, 307 pp.
7. Flexner, A., *Universities: American, English, German.* Oxford Univ. Press, 1930, 381 pp.
8. Flugel, J. C., *Hundred Years of Psychology.* Macmillan Co., 1933, 377 pp.
9. Goodenough, F. L., Trends in Modern Psychology. *Psychol. Bull.,* 1934, 81–97.
10. Klemm, O., *History of Psychology.* (Translated by R. Pintner.) New York: Scribner Sons, 1914, 380 pp.

11. LASKI, H. J., *Dangers of Obedience and Other Essays.* New York and London: Harpers, 1930, pp. 150–177.
12. LEHMAN, H. C., and WITTY, P. A., Statistics Show. *J. Educ. Psychol.,* 1928, **19**, 175–184.
13. MALLER, J. B., Studies in Character and Personality in German Psychological Literature. *Psychol. Bull.,* 1933, **30**, 209–232.
14. MALLER, J. B., Personality and Character Tests. *Psychol. Bull.,* 1934, **31**, 501–524.
15. MORGAN, A., Psychology, Past and Present. *School,* 1907, 16 pp.
16. MURCHISON, C. A., *Psychological Register.* Worcester, Mass.: Clark University Press, 1932 (L. Harden, Ass't. Ed.); Oxford Press, 1932 (H. Milford, Ed.).
17. MURPHY, G., *Historical Introduction to Experimental Psychology.* Harcourt, Brace, 1929. (International Library of Psychology, Philosophy, and Scientific Methods.) Two chapters by Dr. Klüver, 470 pp.
18. PILLSBURY, W. B., *History of Psychology.* W. W. Norton, 1929, 626 pp.
19. *Psychological Abstracts* for the years 1929–1933. American Psychological Association. Worcester, Mass.: Clark University. (W. S. Hunter, Ed.).
20. *Psychological Index* for the years 1894–1933. Worcester, Mass.: Clark University. (W. S. Hunter, Ed.).
21. ROBACK, A. A., *Bibliography of Character and Personality.* Cambridge, Mass.: Sci-Art Publishers, 340 pp.
22. RUSSELL, B., *An Outline of Philosophy.* London, 1927.
23. THURSTONE, L. L., *Reliability and Validity of Tests.* Ann Arbor, Michigan: Edwards.
24. VERNON, P. E., The American vs. the German Approach to the Study of Temperament and Personality. *Brit. J. Psychol.,* 1933, **24**, 156–177.
25. WEBB, L. W., Some Trends in Educational Psychology. *Educ. Trends,* 1934, 20–27.
26. WOODWORTH, R., *Contemporary Schools of Psychology.* New York: Ronald Press, 1931, 232 pp.

VIBRATORY SENSITIVITY: ITS PRESENT STATUS[1]

BY LOUIS D. GOODFELLOW
Northwestern University

Excellent reviews (**86, 120, 121**) of the literature on the sense of touch have appeared which have mentioned briefly vibratory sensitivity. However, a great deal of literature on this topic has escaped these reviews as well as psychological indices. It is summarized here under the following three headings.

I. Neurological and Clinical Data

One of the earliest approaches to the study of vibratory sensitivity was made by Rumpf (**94**, 1889), who concluded that vibrations are limited to the skin. Although many experimenters have believed and some still contend that vibrations are mediated by touch (**5, 56, 23**) spots, evidence of differentiation (**3, 13, 16, 95, 91, 110, 114, 116**) was produced as early as 1897 by Egger (**16**) and Trietel (**110**), when they cited cases in which tactual and vibratory sensitivity were lost independently of each other. Subsequent studies have yielded more specific examples. Piercy (**91**) in a study of 175 out-patient clinic cases found that the vibratory sense is the last to disappear and the first to return in the case of brain disease, but in diseases of the cord, it is the first to be disturbed and the last to return. Williamson (**114**) found that in hemianaesthesia from cerebral lesions, vibratory sensitivity returns before tactual sensitivity. In tabes dorsalis (**116**) the reverse order holds. Anderson (**3**) reports specific changes in each of these modes of sensitivity following the onset of particular diseases. From these data we might infer that the impulses carrying tactile and vibratory experiences are relayed over different nervous pathways in the spinal cord and perhaps in the brain. Vibratory sensations are closely related to the thalamus, Drought and Hill (**13**) believe. As evidence they cite the fact that in Parkinsonism, where there is no cortical impairment but considerable thalamic disturbance, vibratory sensitivity is lost while epicritic sensi-

[1] The author is indebted to Doctors R. H. Gault and S. W. Ranson for their help in running down many of the more obscure references, and for reading the manuscript.

tivity remains practically normal. Head (70, 71) cites a number of cases in which both the ulnar and median nerves were severed at the wrist with loss of superficial sensations but without loss of deep sensibility, including vibratory sensations.

From the experimental approach, evidence pointing to the same conclusion is available. Bing,[2] for example, by anesthetizing various areas of the skin with cocaine, demonstrated that vibratory sensitivity is "not markedly decreased," although other forms of sensitivity are destroyed. The same thing holds after violent rubbing of the skin (74); namely, tactual sensitivity is impaired much more than vibratory sensitivity.

Additional evidence pointing to the existence of an independent sense of vibration is reported by Katz (74, 75, 122), who found that "a tuning fork which produced a very definite sensation when applied to the hand, had an amplitude of 1/3000 of a millimeter which is a movement far too small to give rise to tactual sensations." Furthermore, he cites the fact that the sense of touch tires very readily, but that the vibratory sense shows very little the effects of fatigue. Kampie (73), however, finds evidence of decreased sensitivity due to fatigue. As to adaptation,(74) pressure is much more prompt than the vibratory sense. The latent time of the pressure sense is much shorter than that of the vibratory sense (74) while, according to Fressard (22), the reverse is true of reaction time. And finally, Katz (74) points out, the tongue which is extremely sensitive to pressure, perceives vibrations scarcely at all.

For the sensory pathway for vibratory stimuli, we again cite Head (70), in which he says that the vibratory impulses travel from periphery to cord through fibers arising in muscles, tendons, periosteum, bones, and perhaps the arteries. Entering the cord through the posterior roots, the fibers which carry these impulses ascend uncrossed in the posterior columns without forming a secondary tract. They then cross in the fillet to the opposite side and enter the optic thalamus. That they ascend uncrossed is demonstrated by the Brown-Sequard Syndrome in which vibratory sensation (as well as other forms of deep sensitivity) is absent on the side of the lesion and present on the other side, whereas other superficial sensibility is present on the same side and absent on the opposite. That they ascend the posterior column is shown by disturbances and ultimate loss in such diseases as tabes dorsalis and pernicious anemia. No lesion above the point where the fillet enters the optic thalamus will

[2] Reported by Ahrens (1) without reference.

produce complete insensibility to vibrations, but a lesion in the thalamus may alter vibratory sensations. Stofford (**100**) offers an excellent review and criticism of the anatomy of the so-called deep sensibility.

For the sake of completeness, we will mention a few articles showing the application of this form of sensitivity to the practice of medicine. Armstrong (**4**), after a survey of 116 physicians, lists a considerable number of therapeutic and diagnostic purposes for which they use vibrations. Williamson (**114**) shows how a knowledge of a patient's vibratory sensitivity is quite useful in neurological diagnosis. After various clinical studies, Snow (**99**) lists a dozen different physiological effects due to the application of mechanical vibrations. These effects, such as lowering the threshold of electrical excitability, lessening muscular tension, etc., are very interesting, and if they can be universally demonstrated, may offer a new approach to the study of vibratory sensitivity.

Many physicians are unaware of the extent to which they use their own vibratory sense in diagnosis, according to Kunze (**81**), who showed that percussion can be perceived by the sense of vibration alone. Goetzen (**55**) demonstrated the same thing, namely, that the limits of the heart and lungs could be determined as well without hearing as with it. With his "perkussionsphantom," an instrument for the study of percussion in which the object to be located could be shifted, he eliminated the influence of one's knowledge of anatomy in the experiment.

II. Sensitivity

The limits of sensitivity have been investigated by many different experimenters, and various results are reported. The frequency range which can be perceived by the vibratory sense, Kampie (**73**) sets at 16–1300 d.v. per sec., Thiel (**107**) at 86–528, Knudsen (**80**) at 15–1600, with the prediction that higher frequencies could be felt if the intensity of stimulation were greater. Gault (**41**) reports cases as high as 2700. The present writer (**59**), working in Professor Gault's laboratory with improved apparatus, has had 11 out of 20 observers perceive vibrations as high as 8196. Since the energy of a vibrating body increases as the square of the frequency, the amplitude of vibration necessarily becomes exceedingly small for higher frequencies unless the energy input is greatly increased, which in the cases cited above has not been done. Consequently, the upper limen as reported by many experimenters may be an artifact, *i.e.*, merely a function of the amplitude (**59**).

As to the differential limen, Dunlap (**14**), twenty years ago, by placing a vibrating tuning fork on the palm of the hand, set it at 5 per cent of the standard. Knudsen's observers (**80**) were able to differentiate frequencies varying from 15 to 30 per cent of the standard. Kampie (**73**) places the differential limen at a semi-tone. Roberts (**93**) found that, after careful training, his observers could discriminate frequencies with a difference as little as 2½ per cent of the standard (at 400 d.v. per sec.)—a discrimination approaching the capacity of the ear.

Concerning the intensity threshold, Fressard (**20**) places the minimal energy at .01 erg and possibly in a few cases as low as .001 erg, which is considerably less than von Frey's findings (**24**). This would make the ear about one hundred times as sensitive as the finger-tip. The present writer (**59**) has placed the comparative sensitivity of the ear and finger-tip between 100 and 100,000 times, depending on the frequency of the stimulus.

In terms of amplitude, the threshold as reported by Knudsen (**80**) is .0001 cm. (This makes the ear roughly 1,000 to 10,000 times as sensitive as the finger-tip.) The present writer (**59**) found considerable variation in minimal perceptible amplitude depending upon the observer and the frequency, but in general his data are considerably higher than Knudsen's (**80**).

When it comes to discriminating different intensities, Knudsen (**80**) found that the finger-tip could do about as well as the ear (4 to 12 per cent, depending upon absolute intensity).

Great differences in sensitivity (**1, 61, 80, 81**) exist in different areas of the body. Ahrens (**1**), in a study of 100 cases, found the upper extremities significantly more sensitive than the lower extremities. The present writer (**61**) with data for only six observers found the same thing. He reports the relative sensitivity at 64, 256 and 1,024 d.v. per sec. for twelve different areas of the body. There seems to be little sensitivity in soft parts such as the tongue, although Head (**70**), Williamson (**116**), and Goldschneider (**56**) have independently presented evidence to the contrary.

Thirty-five years ago, Egger (**16**) pointed out that vibratory sensitivity decreases with age, and Rydel and Seiffer (**95**) verified his conclusions, although both reports include many exceptions. Recently, Pearson (**88**) has made a study of 107 patients and concludes that the decrease of sensitivity with age is due to diminished blood supply to central and lateral portions of the column of Goll in the thoracic region. Anderson (**3**) reports data suggesting the same conclusion.

III. The Utilization of Vibratory Sensitivity as an Aid to the Deaf

The relative rôles of tactual and vibratory sensitivity in the use of the Gault-Teletactor [3] have not been definitely established at the present time although a neurological examination of sensory pathways leading to such an objective is under way (61). The importance of vibratory sensitivity in the stimulation received from the Teletactor is suggested by the following facts: vibrations whose amplitude is considerably below the threshold for touch are readily perceptible (74); the tongue (which is very sensitive to touch but not to vibrations) can scarcely perceive stimuli from the Teletactor which are readily perceptible to the finger-tip (61); and a study of the sensitivity of various areas of the body to stimuli from the Teletactor shows no correlation between sensitivity and the distribution of touch receptors (61). Consequently, we consider a brief review of the work of R. H. Gault (28 to 54) and his research staff (8, 10, 11, 12, 58 to 66, 67, 72, 93, 108, 113) appropriate in a summary of the literature on vibratory sensitivity.

Starting ten years ago with a long speaking tube extending through several walls to an observer at the other end of the tube, Dr. Gault tried to teach his observers (by means of touch) to discriminate between different tuning forks set in vibration at the other end of the tube (28). Gradually he has developed highly refined apparatus (62) for communicating speech to the finger-tips of an observer. With this improved apparatus he has collected data showing remarkable possibilities in developing a new avenue of approach to those whose auditory sense has failed to function. They are summarized as follows:

I. Experimental data from the laboratory show that all important elements of speech and music can be perceived through the senses of touch and vibration. For example:

A. The finger-tip can detect vibrations as high as 8,000 per second (59).

B. It can differentiate intensity differences comparable to the ability of the normal ear (80).

C. It can differentiate two pitches when the frequencies concerned differ by as little as 2½ per cent of the standard (93).

[3] This consists (62) of a microphone, a specially designed amplifier, and a vibrator (or receiver) upon which the deaf person places a finger to interpret the vibrations of the speaker's voice.

D. It can detect difference tones and beats (**15**).

E. It can detect the individual tones in a chord and can discriminate between consonance and dissonance (**60**).

F. It can detect differences in short intervals of time with 90 per cent of the accuracy of the ear (**58, 67**).

G. It is only one one-hundredth to one one-hundred-thousandth (depending on pitch) as sensitive as the normal ear (**59**). This is the only score on which the senses of touch and vibration do not compare favorably with the ear, but it is a deficiency which can be compensated for to a considerable degree by apparatus (**62**) such as the Gault-Teletactor.

II. Experimental studies from the school room for the deaf and from the clinic reveal a number of very useful applications of the Teletactor in the education of the deaf (**8, 9, 11, 12, 72, 108, 48, 49, 50, 51**).

A. Deaf pupils feeling their teacher's voice over the Teletactor while reading her lips, find their lip-reading ability increased (on an average) 20 per cent (**51**). With the aid of these vibratory cues, they are able to locate the emphasized word (**108**) and the pauses in speech more successfully; to perceive inflections and the natural phrasing of spoken language (**72**); and to identify many homophenous words (**48**), *i.e.,* words which look alike on the lips of the speaker.

B. The teaching of speech to the deaf is greatly facilitated (**8, 37**), because it helps the child to build a concept of sound and of many of the elements of speech (**9**); it enables him to grasp the "pattern" or "flow" of spoken language (**31**) and consequently put more rhythm into his own speech; and it enables him to compare his speech with that of his teacher, and thus recognize his own particular difficulties (**37**).

C. It facilitates the teaching (**31**) of rhythm and helps the child to carry the idea and principles he has learned in rhythm class into speech and other activities of life.

D. With training, deaf individuals enjoy music and speech (particularly poetry) (**46, 31**) communicated to their fingertips by means of the Teletactor.

III. A few cases are on record of totally deaf individuals who have interpreted speech by means of the senses of touch and vibration

alone (**28, 32**). With the improved apparatus and teaching techniques suggested by Dr. Gault's current research, more individuals will undoubtedly be enabled to accomplish this feat in the future.

BIBLIOGRAPHY

1. Ahrens, R. S., A Study of the Vibratory Sensation. *Arch. Neur. & Psychiat.*, 1925, **14**, 793.
2. Allen, F., and O'Donoghue, C. H., The Post-Contraction Proprioceptive Reflex. *Quar. J. Exp. Physiol.*, 1927, **18**, 199–242.
3. Anderson, F. N., Comparison of the Sense of Vibration and Passive Movement in Organic Neurological Cases. *Med. Herald*, 1929, **48**, 265–266.
4. Armstrong, J. P., Mechanical Vibrations. *Physical Therap.*, 1931, **49**, 311–314.
5. Barker, L. F., Vibration Sense (Pallesthesia). *Monographic Medicine*, 1920, **4**, 136.
6. Bonain, A., Vibrations et ondes Vibratoires. *Arch. Internat. de laryng.*, 1930, **9**, 769–782.
7. Boring, E. G., Cutaneous Sensation After Nerve Division. *Quart. Journ. Exper. Physiol.*, 1916, **10**, 1–95.
8. Carhart, Raymond, A Method of Using the Gault-Teletactor to Teach Speech. *Annals of the Deaf* (awaiting publication).
9. Cloud, D. T., Some Results from the Use of the Gault-Teletactor. *Annals of the Deaf*, May, 1933, pp. 200–204.
10. Crane, G. W., The Tactual Qualities of Spoken Vowels and Diphthongs. *J. Abn. & Soc. Psychol.*, 1928, **22**, 473–479.
11. Dean, Louise Ebeling, Experiments in the Academic Education of Adolescent Deaf Pupils, I. *Annals of the Deaf*, 1934 (Sept.).
12. Dean, Louise Ebeling, Experiments in the Academic Education of Adolescent Deaf Pupils, II. *Annals of the Deaf*, 1934 (Nov.).
13. Drought and Hill, Observations on the Vibratory Sense with Special Reference to Postencephalitic Parkinsonism. *J. Neurol. & Psychopath.*, 1931, **11**, 318–323.
14. Dunlap, K., Palmesthetic Difference Sensibility for Rate. *Amer. Journ. Physiol.*, 1911, **29**, 108–114.
15. Dunlap, K., Palmesthetic Beats and Difference Tones. *Science*, 1913, **37**, 532.
16. Egger, M. M., De la sensibilité osseuse. *J. de Physiol. et de path. gen.*, 1899, **1**, 511–520.
17. Egger, M. M., La sensibilité osseuse. *Rev. Neurol.*, 1906, **16**, 345–351.
18. Fisher, L., and Grundig, J., Vergleich von normal und tangential zur Hautoberfläche Gerichteten Reizen in ihner Wirkung auf den Drucksinn. *Zsch. f. Biol.*, 1927, **86**, 508–515.
19. Flemming Bro., Perception of Vibration in Neuralgias. *Hospitalstid*, 1931, **74**, 1031–1033.
20. Fressard, A., Du minimum d'énergie nécessaire pour l'excitation tactile. *C. r. Soc. Biol.*, 1930, **105**, 699–701.

21. FRESSARD, A., Note sur la comparaison de differents modes d'excitation tactile. *C. r. Soc. Biol.*, 1929, **101**, 1111–1113.
22. FRESSARD, A., Sur la loi de variation des temps de latence en function de l'intensité d'excitation pour les sensations tactiles. *C. r. Soc. Biol.*, 1930, **104**, 1252–1254.
23. VON FREY, M., Die Vergleichung von Gewichten mit Hilfe des Kraftsinns. *Ztsch. f. Biol.*, 1915, **65**, 203–238.
24. VON FREY, M., Eine Bemerkung über Sogenannten Vibrationssinn. *Ztsch. f. Biol.*, 1927, **85**, 539–541.
25. VON FREY, M., and STRUGHOLD, H., Ist der Drunksinn einheitlich oder Zweispaltig? *Ztsch. f. Biol.*, 1927, **86**, 181–186.
26. VON FRISCH, K., and STITTER, H., Untersuchungen über den Sitz des Gehörsinnes dei der Elritze. *Ztsch. f. Vergleichende Physiol.*, 1932, **17**, 686–801.
27. VON FRISCH, K., Die Erforschung des Gehörsinnes bei Fischen, der Wiener kinischen Wochenschrift, 1933, **20**, 1–14.
28. GAULT, R. H., Progress in Experiments on Tactual Interpretation of Oral Speech. *J. Ab. & Soc. Psychol.*, 1924, **19**, 155–159.
29. GAULT, R. H., An Experiment in the Recognition of Speech Sounds by Touch. *J. Wash. Acad. Science*, 1925, **15**, 320–328.
30. GAULT, R. H., Control Experiments in Relation to Identification of Speech Sounds by Aid of Tactual Cues. *J. Ab. & Soc. Psychol.*, 1926, **21**, 5–13.
31. GAULT, R. H., Extension of the Uses of Touch for the Deaf. *School & Society*, 1926, **23**, 368–370.
32. GAULT, R. H., On the Identification of Spoken Words by Their Tactual Qualities. *J. Appl. Psychol.*, 1926, **10**, 75–88.
33. GAULT, R. H., On the Interpretation of Speech Sounds by Means of Their Tactual Correlates. *Annals Otol., Rhin. & Laryng.*, 1926, **3**, 121–136.
34. GAULT, R. H., Tactual Interpretation of Speech. *Scientific Monthly*, 1926, **22**, 126–131.
35. GAULT, R. H., The Interpretation of Speech by Tactual and Visual Impressions. *Arch. Otolaryngol.*, 1926, **4**, 228–239.
36. GAULT, R. H., Touch as a Substitute for Hearing in the Interpretation and Control of Speech. *Arch. Otolaryng.*, 1926, **3**, 121–135; *J. Wash. Acad. Science*, 1926, **16**, 50–51.
37. GAULT, R. H., Drafting the Sense of Touch in the Cause of Better Speech. *J. Expression*, 1927, **1**, 126–131.
38. GAULT, R. H., Hearing Through Sense Organs of Touch and Vibration. *J. Franklin Inst.*, 1927, **204**, 329–358.
39. GAULT, R. H., "Hearing" by Touch; Demonstration of a Case. *The Laryngoscope*, March, 1927, 3–8.
40. GAULT, R. H., On the Identification of Certain Vowel and Consonantal Elements in Words by Tactual Qualities and by Their Visual Qualities as Seen in Lip-reading. *J. Ab. & Soc. Psychol.*, 1927, **22**, 33–39.
41. GAULT, R. H., The Upper Limit of Vibration That Can Be Recognized by Touch. *Science*, 1927, **65**, 403–404.
42. GAULT, R. H., Progress in Experiments on the Interpretation of Speech by Touch. *J. Abn. & Soc. Psychol.*, 1925, **20**, 118–127.

43. GAULT, R. H., Fingers Instead of Ears. *Welfare Magazine,* 1927, **17,** 1131–1138.

44. GAULT, R. H., Learning Language by Its Feel. *Scientific American,* 1927, **137,** 524–525.

45. GAULT, R. H., Studies in the Psychology of Touch. *Carnegie Inst. of Wash. Yearbook,* 1926–1927, **27,** 401–407, and 1928–1929, **28,** 403–414.

46. GAULT, R. H., *Pleasurable Reactions to Tactual Stimuli,* pp. 247–254, *Feeling and Emotions—a Symposium.* Edited by Carl Murchison. Clark Univ. Press, 1928.

47. GAULT, R. H., and CRANE, G. W., Tactual Patterns from Certain Vowel Qualities Instrumentally Communicated from a Speaker to a Subject's Fingers. *J. Gen. Psychol.,* 1928, **1,** 353–359.

48. GAULT, R. H., On the Discrimination of Homophenous Words by Tactual Signs. *J. Gen. Psychol.,* 1929, **2,** 212–231.

49. GAULT, R. H., On the Effect of Simultaneous Tactual-Visual Sensations in Relation to the Interpretation of Speech. *J. Ab. & Soc. Psychol.,* 1930, **24,** 498–517.

50. GAULT, R. H., On the Effect of Simultaneous Tactual-Visual Stimulation in Relation to the Interpretation of Speech. *Transactions Illinois State Acad. of Science,* 1930, **22,** 630–653.

51. GAULT, R. H., A Partial Analysis of the Effects of Tactual-Visual Stimulation by Spoken Language. *J. Franklin Inst.,* 1930, **209,** 437–458.

52. GAULT, R. H., The American Institute for the Deaf-Blind. *Rehabilitation Review,* 1933, **7,** 1–7.

53. GAULT, R. H., and GOODFELLOW, L. D., Eliminating Hearing in Experiments on the Tactual Reception of Speech. *J. Gen. Psychol.,* 1933, **9,** 223–228.

54. GAULT, R. H., An Interpretation of Vibro-Tactile Phenomena. *Jour. Acoustical Society of Amer.,* 1934, **5,** 252–255.

55. VON GOETZEN, C., Die Psychologischen Grundlagen der Perkussion. *Ztsch. f. Psychol.,* 1929, **112,** 55–92.

56. GOLDSCHNEIDER, Über das Vibrations-gefühls. *Berl. klin. Wchnschr.,* 1904, **41,** 353–356.

57. GOLDSTEIN, MAX A., The Relation of Tactual Impression and Hearing Perception. *The Laryngoscope,* 1926, Oct., 1–20.

58. GOODFELLOW, L. D., Comparison of Audition, Vision and Touch in the Discrimination of Short Intervals of Time. *Amer. J. Psychol.,* 1934, **46,** 243–258.

59. GOODFELLOW, L. D., The Sensitivity of the Finger-tip to Vibrations of Various Frequency Levels. *J. Franklin Inst.,* 1933, **216,** 387–392.

60. GOODFELLOW, L. D., The Tactual Perception of Musical Intervals. *J. Franklin Inst.,* 1933, **215,** 731–736.

61. GOODFELLOW, L. D., The Sensitivity of Various Areas of the Body to Vibratory Stimuli. *Jour. Gen. Psychol.,* 1934.

62. GOODFELLOW, L. D., and KRAUSE, A. W., Apparatus for Receiving Speech Through the Sense of Touch. *Review of Scientific Inst.,* 1934, **5,** 44–46.

63. GOODFELLOW, L. D., Experiments on the Senses of Touch and Vibration. *Jour. Acoustical Society of America,* 1934, **6,** 45–50.

64. GOODFELLOW, L. D., The Phenomena of Tonal Masking in the Detection of Vibro-Tactile Stimuli. To be published in the *J. Gen. Psychol.*
65. GOODFELLOW, L. D., and GAULT, R. H., The Rôle of Meaning in Learning to Recognize Sentences by Their Vibro-Tactual Patterns. To be published in the *J. Gen. Psychol.*
66. GOODFELLOW, L. D., and ILIEVA, M. L., On the Intensity Criterion for Vibro-Tactile Discrimination. *J. Gen. Psychol.* (Oct.).
67. GRIDLEY, PEARL, The Discrimination of Short Intervals of Time by Finger-tip and by Ear. *Amer. J. Psychol.*, 1932, **44**, 18–43.
68. HARVEY, E. N., and LOOMIS, A. L., High Speed Photomicrography of Living Cells Subjected to Supersonic Vibrations. *J. Gen. Physiology*, 1931, **15**, 147–153.
69. HEAD, HENRY, Sensation and the Cerebral Cortex. *Brain*, 1918, **41**, 57–253.
70. HEAD, HENRY, *Studies in Neurology*. London: Oxford University Press, 1920. Vol. 1, pp. 143; Vol. 2, pp. 591.
71. HEAD and RIVERS, A Human Experiment in Nerve Division. *Brain*, 1908, **31**, 323–450.
72. ILIEVA, M. L., A Comparison of the Sense of Touch Alone, the Sense of Vision (Lip-reading) and Both Working Together in Respect to the Detection of Change in the Tempo of Speech. *J. Gen. Psychol.*, 1934, **10**, 100–109.
73. KAMPIE, A., Experimentelle Untersuchungen über die praktische Leistungsfahigkeit der Vibrationsempfinden. *Arch. f. d. ges. Psychol.*, 1930, **76**, 3–70.
74. KATZ, D., The Vibratory Sense and Other Lectures. *The Maine Bulletin*, 1930, **32**, 10.
75. KATZ, D., *Der Aufbau der Tastwelt*. Leipzig: Barth, 1925.
76. KATZ, D., Über die Natur des Vibrationssinns. *München med. Wchnschr.*, 1923, **70**, 706.
77. KATZ, D., Vibrationssinn und Rhythmus. *Zsch. f. Aesth.*, 1927, **21**, 208–215.
78. KATZ, D., and NODT, F., Über die kleinsten Vibratorisch Wahrnehmbaren Schwingungen. *Zsch. f. Psychol.*, 1925, **99**, 104–145.
79. KIETZMANN, O., Zur Lehn von Vibrationssinn. *Zsch. f. Psychol.*, 1926, **101**, 377–422.
80. KNUDSON, V. O., Hearing with the Sense of Touch. *J. Gen. Psychol.*, 1928, **1**, 320–352.
81. KUNZE, J., Perkussionsleistungen Gehörloser. *Zsch. f. Psychol.*, 1932, **125**, 289–293.
82. LALANNE, Sur la durée de la sensation tactile. *C. R. de L'acad. des. sci.*, 1876, **82**, 1314–1316.
83. LETZTER, MARGARET, Enriching the Vocabulary. *Annals of the Deaf* (awaiting publication).
84. LOEBELL, H., Vibrotherapy with Oto-audion. *Zsch. f. Hals- Masen u. Ohrend*, 1931, **28**, 583–585.
85. MCKINLEY, J. C., A Simple Method for Determining the Threshold Value of Vibratory Sensitivity. *Proc. of Soc. Exp. Biol. & Med.*, 1928, **25**, 827–831.

86. METCALF, J. T., Cutaneous and Kinaesthetic Sense. *Psychol. Bull.*, 1928, **25**, 569–581.
87. NOLDT, F., Ein Vibrator zu Psychologischen Zwecken. *Ztsch. f. Psychol.*, 1926, **100**, 242–243.
88. PEARSON, G. H. J., The Effect of Age on Vibratory Sensitivity. *Arch. Neur. & Psychiat.*, 1928, **20**, 482–496.
89. PETELIN, S. M., Nature and Conveyors of Vibratory Sensitivity. *Klin. med.*, 1931, **9**, 560–562.
90. PETZOLDT, S., Experimentelle Beiträge zur Lehre vom Vibrationssinn. *Ztsch. f. Psychol.*, 1928, **108**, 155–194.
91. PIERCY, H. D., Quantitative Measurement of Vibratory Sensation. *Ohio State M. J.*, 1923, **19**, 572–577.
92. POLLOCK, K. G., and BARTLETT, M. A., Psychological Experiments on the Effect of Noise. *Indus. Health Res. Board*, 1932, **65**, 1–37.
93. ROBERTS, W. H., A Two-Dimensional Analysis of Discrimination of Differences in the Frequency of Vibrations by Means of the Sense of Touch. *Jour. Frank. Inst.*, 1932, **213**, 286–312.
94. RUMPF, Ueber einen Fall von Syringomyelie nebst Beitragen zur Untersuchung der Sensibilität. *Neurol. Centrabl.*, 1889, **8**, 185–190.
95. RYDEL, A., and SEIFFER, W., Untersuchungen über das Vibrationsgefühl. *Arch. f. Psychiat. u. Nervenk.*, 1907, **37**, 486–536.
96. SCHAFER, E. S., Recovery After Severance of Cutaneous Nerve. *Brain*, 1929, **50**, 538–545.
97. SCHAFER, E. S., Permanent Results of Denervation of Cutaneous Area. *Quart. J. Exper. Physiol.*, 1930, **20**, 95–99.
98. SCHAFER, E. S., The Effect of Denervation of Cutaneous Areas. *Quart. J. Exp. Physiol.*, 1928, **19**, 85–107.
99. SNOW, M. L. H. A., Physiological Effect of Mechanical Vibration. *Physical Therap.*, 1928, **46**, 113–123.
100. STOFFORD, J. B. S., The Anatomy of So-called Deep Sensibility. *Jour. Anat.*, 1922–1923, **57**, 199.
101. STRUGHOLD, H., Über die Dichte und Schwellen der Schmerz punkte der Epidermis in den verschiedenen Körperregionen. *Ztsch. f. Bio.*, 1924, **80**, 367–380.
102. SUYEHIRO, K., (In German) Perception of Vibrations. *Imp. Acad. Tokyo Proc.*, 1929, **5**, 411.
103. SYMS, J. L. M., An Accurate Method of Estimating Vibratory Sensitivity. *Brit. Med. J.*, 1912, **1**, 539–540.
104. SYMS, J. L. M., A Method of Estimating Vibratory Sensitivity. *Quart. J. Med.*, 1917, **11**, 33–58.
105. TAKANO, J., Experimental Investigation of Vibration Sensations. *Jap. J. Psychol.*, 1933, **8**, 73–91 (German Abstract).
106. TAIT, JOHN, Is All Hearing Cochlear? *Annals of Otol., Rhin. and Laryng.*, 1932, **41**, 681–705.
107. THIEL, F. C., Experimental Studies in the Vibratory Sense in Deaf Mutes. *Ztschr. f. Psychol. u. Physiol. d. Sinnes Org.*, 1931, **119**, 109–178.

108. THOMPSON, D., On the Detection of Emphasis in Spoken Sentences by Means of Visual, Tactual and Visual-Tactual Cues. *J. Gen. Psychol.*, 1934 (Oct.).
109. THOMPSON, M., and others, Estimation of Cutaneous Nerve Areas of Forearm and Hand (Abstract). *Anat. Rec.*, 1930, **45**, 245.
110. TRIETEL, Ueber das Vibrationsgefühl. *Arch. f. Psychiat.*, 1897, **29**, 633–640.
111. TROTTER, W., A Lecture on the Sensibility of the Skin in Relation to Neurological Theory. *The Lancet*, 1924, **206**, 1252–1256.
112. VALENTIN, G., Ueber die Dauer die Tasteindrücke. *Arch. f. Physiol. Heilk.*, 1852, **11**, 438.
113. WEICHBODT, M., Tactual Compared With Visual Discrimination of Consonantal Qualities. *Jour. Gen. Psychol.*, 1932, **6**, 203–206.
114. WILLIAMSON, R. T., Vibrating Sensations in Disease of the Nervous System. *Am. J. M. Sc.*, 1922, **164**, 715–727.
115. WILLIAMSON, R. T., Vibrating Sensations in Affections of Nervous System and in Diabetes. *Lancet*, 1905, **2**, 855–856.
116. WILLIAMSON, R. T., Vibrating Sensations in Diseases of Nervous System. *Brit. Med. Jour.*, 1907, **2**, 125–127.
117. VON WITLICH, Bemerkungen zu Preyer's Abhandlung über die grenzen des Empfindungsvermögens und Willens. *Pflüger's Archiv*, 1869, **2**, 329–350.
118. WOOD, E. J., Further Studies of Qualitative Variation in Vibration Sensation. *Tr. A. Am. Phys.*, 1921, **36**, 368–379.
119. WOOD, E. J., The Quantitative Estimation of Vibration Sensations. *Guy's Hospital Report*, 1921, **71**, 78–90.
120. ZIEGLER, M. J., Touch and Kinesthesis. *Psychol. Bull.*, 1930, **27**, 298–317.
121. ZIEGLER, M. J., Touch and Kinesthesis. *Psychol. Bull.*, 1932, **29**, 260–278.
122. ZIEGLER, M. J., Review of Katz's Work. *Psychol. Bull.*, 1926, **23**, 326–336.

PROCEEDINGS OF THE NINTH ANNUAL MEETING OF THE MIDWESTERN PSYCHOLOGICAL ASSOCIATION

JOHN A. MCGEOCH, SECRETARY, UNIVERSITY OF MISSOURI

The Ninth Annual Meeting of the Midwestern Psychological Association was held May 10, 11 and 12 at Purdue University under the Presidency of Professor John J. B. Morgan, Northwestern University. About 300 persons attended.

It was voted at the business meeting to change the dues for membership to one dollar per year and to publish annually a yearbook containing the names and addresses of members. It was voted to hold the 1935 meeting at the University of Kansas, Lawrence.

The newly elected officers of the Association are:

President, 1934–1935: John A. McGeoch, University of Missouri.

Secretary-Treasurer, 1934–1937: Arthur G. Bills, University of Chicago.

Council, 1934–1937: James P. Porter, Ohio University.

PROGRAM

THURSDAY, MAY 10

SYMPOSIA

A. *The Relation of Psychology to the Social Sciences.*

Presiding: R. H. WHEELER, University of Kansas.

Speakers: 1. RAYMOND H. WHEELER—*The Future of Psychology in Social Science.*

2. J. F. BROWN—*The New Field Theory of Social Behavior.*

B. *The Relation of Psychology to Psychiatry.*

Presiding: MARTIN L. REYMERT, Mooseheart, Illinois.

Speakers: 1. MANDEL SHERMAN, University of Chicago—*Psychiatry.*

2. C. H. CALHOUN, Columbus Bureau of Juvenile Research—*Psychology.*

3. LOWELL SELLING, Chicago Institute of Juvenile Research—*Psychiatry.*

4. LUTON ACKERSON, Mental Health Hospital, Illinois State Prison—*Psychology.*

C. *Reading Disability.*

Presiding: THORLEIF G. HEGGE, Wayne County Training School and University of Michigan.

Introductory Speaker: DEAN WILLIAM S. GRAY, University of Chicago.

FRIDAY, MAY 11

SECTION A

O. C. TRIMBLE, Purdue University, *Chairman*

1. *A Correlational Study of "Drives" in the Male Albino Rat.* E. E. ANDERSON, University of Illinois.
2. *A Study of the Cortex in Birds with Particular Reference to Pattern Vision.* JOHN D. LAYMAN, University of Chicago.
3. *The Cortical Area Concerned with Coördinated Walking in the Rat.* NORMAN R. F. MAIER, University of Michigan.
4. *Effect of Various Preferred Goal Objects on Efficiency of Performance of Primates in Delayed Reaction.* A. H. MASLOW, University of Wisconsin.
5. *Some Effects of Suprarenalectomy upon the Learning of White Rats in the Water Maze.* JOHN E. WENRICK, The Ohio State University.

SECTION B

V. C. HENMON, University of Wisconsin, *Chairman*

1. *Continuous, Quantitative Measurement of Sweat Secretion—Medical, Psychological, and Galvanometric Applications.* CHESTER W. DARROW, Behavior Research Fund and Institute for Juvenile Research, Chicago.
2. *Analysis of Human Electromyograms in Terms of Single Motor Units.* D. B. LINDSLEY, Harvard Medical School.
3. *Examination of the Conditioned Salivary Reflex Induced by Pilocarpine.* G. FINCH and E. CULLER, University of Illinois.
4. *The Sensitivity of Various Areas of the Body to Vibratory Stimuli.* LOUIS D. GOODFELLOW, Northwestern University.
5. *The Fundamental Significance of Contour for the Perception of Visual Objects.* HEINZ WERNER, University of Michigan.

FRIDAY, MAY 11

SECTION C

G. D. STODDARD, University of Iowa, *Chairman*

1. *The Reactions of Newborn Infants to Pain Stimulation.* F. C. DOCKERAY, The Ohio State University.
2. *An Analysis of Certain Factors Influencing the Performance of Preschool and School Children in Discriminating Pitch Differences; a Suggested Method for Testing Pitch Discrimination Below the Sixth Grade.* MELVIN S. HATTWICK, Child Welfare Research Station, University of Iowa.
3. *An Experimental Study of the Psychoneurotic Syndrome in Childhood.* FRED BROWN, State Bureau of Juvenile Research, Columbus, Ohio.
4. *Innate Emotional Responses in Infants.* JAMES H. TAYLOR, The Ohio State University.
5. *Common Determinants of Affect and Recall.* RICHARD LEDGERWOOD, University of Illinois.

SECTION D

J. P. PORTER, Ohio University, *Chairman*

1. *A Psychogenetic Theory of the Affective Life.* CHRISTIAN A. RUCKMICK, University of Iowa.
2. *The Problem of Isolating Mental Abilities.* L. L. THURSTONE, University of Chicago.
3. *The Scientific Nature of Psychology.* HULSEY CASON, University of Wisconsin.
4. *Some New Organismic Laws.* R. H. WHEELER and F. T. PERKINS, University of Kansas.
5. *A Methodological Examination of Freudian Psychoanalysis.* J. F. BROWN, University of Kansas.

FRIDAY, MAY 11

ANNUAL DINNER

MEMORIAL UNION

Toastmaster: HERBERT WOODROW, University of Illinois

Address of Welcome: PRESIDENT EDWARD C. ELLIOTT, Purdue University.

"Psychology in a Technological Civilization." DEAN A. A. POTTER, Purdue University.

ADDRESS OF THE PRESIDENT

"Psychoses of Business." JOHN J. B. MORGAN, Northwestern University.

SATURDAY, MAY 12

SECTION E

J. B. MINER, University of Kentucky, *Chairman*

1. *The Fraternity Initiation Requirement as an Artificial Stimulus.* HARVEY C. LEHMAN, Ohio University.
2. *Experimentation to Discover Measurable Aptitudes for Engineering.* CLAIR V. MANN, Missouri School of Mines and Metallurgy.
3. *Experimental Study of Individual Variation in Mob Behavior.* N. C. MEIER, G. MENNENGA, and H. J. STOLZ, University of Iowa.
4. *"College Problem" Testing Program with Freshman Men.* JAMES P. PORTER, LEONARD L. HENNINGER, and CHARLES E. FIDDLER, Ohio University.
5. *Some Limitations of Experimentation in Applied Psychology.* C. C. Ross, University of Kentucky.

SECTION F

S. L. PRESSEY, The Ohio State University, *Chairman*

1. *The Differentiative Effects of Age upon Human Learning Ability.* FLOYD L. RUCH, University of Illinois.
2. *The Age Factor in Reminiscence: A Second Comparative Study of Preschool Children and College Students.* GRACE O. MCGEOCH, Stephens College.
3. *The Character and Extent of Transfer in Retroactive Inhibition.* FRED MCKINNEY and JOHN A. MCGEOCH, University of Missouri.
4. *Regarding Trial and Error.* CLELLAN L. MORGAN, Purdue University.
5. *The Retention of Affectively Toned Experiences of Daily Life.* R. H. WATERS, University of Arkansas, and R. W. LEEPER, University of Chicago.

SATURDAY, MAY 12, 1:30 P.M.

REPORTS FROM THE LABORATORIES

G. C. BRANDENBURG, Purdue University, *Chairman*

ANNUAL BUSINESS MEETING

PROCEEDINGS OF THE TWENTY-NINTH ANNUAL MEETING OF THE SOUTHERN SOCIETY FOR PHILOSOPHY AND PSYCHOLOGY, MARCH 30 AND 31, 1934

REPORT OF THE SECRETARY, LYLE H. LANIER, VANDERBILT UNIVERSITY

The Southern Society for Philosophy and Psychology held its twenty-ninth annual meeting in Birmingham, Alabama, on March 30 and 31, 1934, at the invitation of Birmingham-Southern College. The Tutwiler Hotel was the headquarters of the Society; all sessions were held in the hotel.

Separate philosophy and psychology sessions were held on Friday morning and afternoon, March 30, and on Saturday afternoon, March 31. A joint program, which included only theoretical papers, preceded the annual business meeting on Saturday morning. Nineteen psychology and twelve philosophy papers were presented. The philosophy session on Saturday afternoon was devoted to a round-table discussion of the teaching of philosophy in colleges. Dr. H. C. Sanborn, chairman of the Committee on the Teaching of Philosophy, presided at this session.

The annual meeting of the Council was held on Thursday evening, March 29. The following members of the Council were present: Balz, Dorcus, Dunlap, Geldard, Lanier, Liddell, Sanborn.

MINUTES OF THE ANNUAL BUSINESS MEETING

The reading of the minutes of the Washington meeting was omitted; these minutes were approved as printed in the PSYCHOLOGICAL BULLETIN of October, 1933.

The treasurer presented a report for the fiscal year 1933–1934. This report, which had been audited by Dr. Joseph Peterson and approved by the Council, was accepted. Receipts of $207 and disbursements of $209.07 were announced, the latter including the payment of four large bills outstanding from last year. A cash balance of $336.37, as of March 28, 1934, was reported.

The secretary announced that the Council had received a report of the work done by the Committee on the Teaching of Philosophy. The Council recommended that the Committee be continued, that it

be asked to prepare a digest and summary of the data collected, together with such recommendations as it may deem desirable, and, with the approval of the Council, that such a report be transmitted to the institutions concerned. It was voted that the report of the Committee be accepted and that the recommendation of the Council be approved.

Dr. P. F. Finner, chairman of the Committee on the Teaching of Psychology, presented a long mimeographed report embodying the work of this Committee. The data were secured from 113 institutions during the spring of 1933. Information was secured on the status of psychology in the curriculum, the nature of the introductory course and other undergraduate courses, laboratory equipment, library facilities, teaching personnel, and research in psychology. The report included also a revised list of Southern institutions offering work in psychology which conformed to the minimum standards adopted at the Lexington, Ky., meeting on April 3, 1926. The Council recommended that this report of the chairman be placed on file subject to the approval of the Committee as a whole, and that further release of the report to outside institutions or individuals be withheld until such release is approved by the Council. After considerable debate this recommendation was approved. It developed in the discussion that certain members of the Committee had not seen the report before it was printed, and that certain institutions had been omitted from the list of approved colleges.

No report was received from the Committee on Teaching the First Course in Psychology. The Council recommended that the secretary be instructed to ascertain from Dr. F. C. Dockeray, the chairman of this joint committee with the Midwestern Psychological Association, whether or not this committee still functioned, and that if so the President appoint such members as he might wish to represent the Society. Dr. J. B. Miner, the secretary of the Committee, was present and outlined the work of the Committee to date. He stated that copies of the minutes of previous meetings of the Committee would be sent to the secretary of the Society. No action was taken on the Council recommendation.

The Society voted, upon recommendation of the Council, to discontinue the publication of abstracts of papers in the Proceedings which appear in the PSYCHOLOGICAL BULLETIN. Inasmuch as the BULLETIN found it necessary to charge for such printing of abstracts, it was considered advisable to discontinue their publication, due to the expense.

The Council recommended the following changes in the Constitution:

1. The omission of "Experimental Education" from Article I, Section 2.

2. That Article II, Section 1, be changed to read as follows: "In order to be eligible for membership in the Society candidates shall be professionally engaged in the fields of philosophy and/or psychology, or shall have pursued, for not less than two years, a program of graduate study primarily devoted to philosophy and/or psychology." Action upon these proposed changes will be taken at the next annual meeting of the Society.

The following new members were elected, upon recommendation of the Council:

Agnew, Donald C., Winthrop College, Rock Hill, S. C.
Disher, Dorothy, Florida State College for Women, Tallahassee, Fla.
Gilmer, Beverly von H., University of Virginia, University, Va.
Godard, James McF., Duke University, Durham, N. C.
Hathorn, John B., Duke University, Durham, N. C.
Hewson, Cecile B., University of Virginia, University, Va.
Jarman, Arthur M., University of Virginia, University, Va.
McCall, W. Morrison, Milligan College, Milligan College, Tenn.
McDonald, Ralph W., Salem College, Winston-Salem, N. C.
McEwen, Noble R., Salem College, Winston-Salem, N. C.
Meadows, Thos. B., Georgia State College for Women, Milledgeville, Ga.
Ralston, Harold J., Erskine College, Due West, S. C.
Wingfield, Robert C., University of Virginia, University, Va.
Weaver, Rufus W., American University, Washington, D. C.

The following officers were elected, upon recommendation of the Council: President, Dr. John E. Winter, West Virginia University; Secretary-Treasurer, Lyle H. Lanier, Vanderbilt University; to the Council, Dr. A. G. A. Balz, University of Virginia, and Dr. Frank A. Pattie, Rice Institute.

A vote of appreciation was extended to Birmingham-Southern College, to the Birmingham Chamber of Commerce, and to Dr. J. E. Bathurst, for the admirable arrangements made for the meetings.

The secretary announced that invitations for the 1935 meeting had been received from The Johns Hopkins University, and from Vanderbilt University and George Peabody College (jointly). It was voted to accept the latter invitation, in view of the central location of Nashville. The 1935 meeting will be held on April 19 and 20, the Friday and Saturday before Easter.

PROGRAM

Research in Psychology in Colleges. ROY M. DORCUS, The Johns Hopkins University.[1]

I. Psychology Papers

A Method for the Investigation of Palmesthetic Sensitivity. BEVERLY VON HALLER GILMER, University of Virginia.

The Diminished Seventh, Excitement, and Musical Relativity. CHRISTIAN PAUL HEINLEIN, Florida State College for Women.

An Explanation of the Apparent "Persistency" in the Auditory Mechanism. R. C. WINGFIELD, University of Virginia.

A Case of Anomalous Localization in a Skin Graft. LYLE H. LANIER and BEVERLY DOUGLAS, Vanderbilt University.

Visual Factors Influencing the Duration of Post-Rotational Nystagmus. O. H. MOWRER, Princeton University.

Flicker Relations Within the Fovea. FRANK A. GELDARD, University of Virginia.

Timing Devices in the Psychology Laboratory. KNIGHT DUNLAP, The Johns Hopkins University.

An Experimental Study of Human Instincts: A Preliminary Report. WAYNE DENNIS, University of Virginia.

The Maturation and Learning of Serial Reaction Time and Muscular Coördination Involving Visual Stimuli. A. O. GAMBLE and J. E. BATHURST, Birmingham-Southern College.

Equivalent Stimulation During Learning. DAEL L. WOLFLE, University of Mississippi.

The Undergraduate Curriculum in Psychology. P. F. FINNER, Florida State College for Women.

Modern Nerve-Physiology and Descartes' Doctrine of the Production of Bodily Movement. H. M. JOHNSON, American University.

The Development of Judgments of Traits Through Practice and Correction. HERMON W. MARTIN, Emory University.

The Selection of Students for Mental Nursing. G. WILSON SHAFFER, University of Baltimore.

[1] The address of the President of the Southern Society for Philosophy and Psychology.

The Effects of Hypnotically Suggested Blindness. FRANK A. PATTIE, JR., Rice Institute.

The Relation Between Pitch Discrimination and Accent in Modern Languages. EMILY S. DEXTER, Agnes Scott College.

Measuring Attitudes Towards the Specific Social Rights of the Negro. EURI BELLE BOLTON, Georgia State College for Women.

The Inter-Relations of Certain Physiological Measurements and Aspects of Personality. KATHERINE T. OMWAKE, Agnes Scott College.

The Use of the Drake Musical Memory Test for Awarding Scholarships. RALEIGH M. DRAKE, Wesleyan College.

II. Philosophy Papers

The Great Analogy in Idealism. LEROY E. LOEMKER, Emory University.

Logic and Functionalism. PETER A. CARMICHAEL, Converse College.

The Constancy of Human Values. W. PRESTON WARREN, Furman University.

The German Church and Liberalism. FRITZ MARTI, Hollins College.

Measurement in Plato's Republic. LEWIS M. HAMMOND, University of Virginia.

The Metaphysical Postulates of Mediæval Aesthetics. KATHERINE GILBERT, Duke University.

A Basis for Modern Ethics. ANNA FORBES LIDDELL, Florida State College for Women.

Ethical Relativity. MARJORIE S. HARRIS, Randolph-Macon Woman's College.

Thought as Awareness and Thought as Behavior. MARTEN TEN HOOR, Tulane University.

St. Thomas and the Establishment of Modern Science. ALBERT G. A. BALZ, University of Virginia.

The Problem of Psychic Reality. HERBERT C. SANBORN, Vanderbilt University.

The Secret of Aristotle. GEORGE G. LECKIE, University of Virginia.

PROCEEDINGS OF THE WESTERN PSYCHOLOGICAL ASSOCIATION, BERKELEY, CALIFORNIA, JUNE 21–23, 1934

ROBERT C. TRYON, *Secretary, University of California*

The Association met with Section I, of the A.A.A.S., on the occasion of the latter organization's summer meeting at Berkeley. On June 21, joint sessions with Section Q, A.A.A.S., were held, the afternoon session of which consisted of a symposium, arranged by W.P.A., on "Can Personality Be Measured?". Approximately 200 attended. The chairman of local arrangements was C. W. Brown.

Officers elected for the ensuing year, 1934–1935, were:

President—H. E. Jones, University of California, Berkeley.
Vice-President—R. H. Seashore, University of Oregon, Eugene.
Secretary-Treasurer—R. C. Tryon, University of California, Berkeley.

The Association will again meet with the A.A.A.S., in June, 1935, at the University of California at Los Angeles.

PROGRAM

Issues in the Field of Personality Measurement. STEVENSON SMITH, University of Washington.

Personality should be defined as the behavior we measure in order to determine the probability of a man's acting in certain ways. The personality trait names commonly used do not always serve to designate these signs of expected action. Personality should not be thought of as a cause of behavior but merely as a prognostic sign. Although there is no definitive difference between character traits and personality traits, the criteria of the former are chiefly end results in practical conduct and the criteria of the latter are chiefly emotional and ideational states.

Personality Theories in Relation to Measurement. BARBARA S. BURKS, University of California.

We need proof that the numerical label which we attach to a purported measurement corresponds to some tendency which really

exists in the individual. Specifists and factorists have adduced no convincing evidence in support of their viewpoints on measurable traits. Neither have the psychologists who advocate a theory of general traits occurring in the general population. In support of a hypothesis of constellations of tendencies occurring typically or uniquely in single individuals but not in the general population, are (1) studies which show prognosis tests to work toward an "all-or-none" principle, (2) studies which show unique and persistent patterns of relationship between overt response and galvanic deflection to emotional stimuli, (3) studies which show predictability of response to new stimuli from intimate knowledge of preschool subjects, and (4) studies which suggest organized behavior trends that can be identified by raters but not by composite inventory scores. These results indicate possible approaches for developing measuring instruments.

A Program for the Measurement of Adolescent Personality. M. C. JONES, University of California.

An adolescent growth study at the University of California Institute of Child Welfare provides for the cumulative investigation of the same group of 200 children over a period of six years beginning in preadolescence and running through the early adolescent years. Measurements of physical growth, physiological function, motor performance, and intellectual ability have been made in the hope that concomitant variables may be discovered which are significant for personality. In a more direct approach such techniques as are usually referred to as "personality measurements" have been employed with the hope of achieving some valid criteria of personality changes. Group tests include self-report inventories, interest and attitude questionnaires and associates' ratings. Observations in a variety of situations (metabolism laboratory, classrooms, lunch and free-play periods, etc.) are recorded by means of ratings on such personality traits as self-expressiveness, social prestige, poise, and by means of time-frequency records of talking, smiling and the like. A primary aim of the study is to obtain individual growth curves in a variety of functions, rather than group norms.

The Factor Approach to Personality Measurement. TRUMAN L. KELLEY, Harvard University.

Personality Measurement from the Standpoint of a Mathematician. E. B. WILSON, Harvard University.

Personality Measurement from the Standpoint of a Consulting Psychologist. WM. S. CASSELBERRY, Los Angeles.

Personality may be defined as (1) everything about a person which can affect another person's receptors, such as appearance, movements, odors, sounds, etc., or (2) the aggregate of the mental and emotional characteristics of an individual. There is a relationship between the physical characteristics and one's emotional reactions (Adler). Consequently assuming that this relationship between (1) and (2) is absolute, if we have a perfect measurement for both of these, the correlations between them would be perfect. The r of $.47 \pm .06$ obtained between (1), secured by a personal rating, and (2), as measured by the Bernreuter Personality Inventory would seem to indicate a certain degree of ability on the part of the Inventory to measure personality, as defined under (1) above (70 office cases). Assuming social adjustment to be a measure of a person's personality, the r of $.52 \pm .08$ between a personal estimate of social adjustment and the Bernreuter scores would also indicate some ability on the part of the Bernreuter Inventory to test personality (33 radio cases).

Personality Measurement from the Point of View of the Psychiatrist. DONALD A. MACFARLANE, University of California Hospital.

The value of personality measurement in the practice of clinical psychiatry is minimized in the light of the following considerations: (1) Clinical psychiatry concerns itself with the individual and his individual problems. (2) A quantitative statement reflecting the *number* of trends in any given category is of negligible importance; it is the highly specific nature and implications of the trends that constitute the focus of attention. (3) Generally speaking, the psychiatric patient has passed the point of objective interest in applying abstract titles to categories of traits. (4) Most patients in the clinical situation do not work deductively, *i.e.*, from the broad categories which personality tests are supposed to measure down to the particulars that are characteristic of them; rather the opposite. (5) The few who are sophisticated enough to begin thinking in terms of the broad abstractions tend unconsciously to avoid the discomfort of genuine insight by intellectualizing the whole therapeutic situation, by manipulating the jargon, by making of the discussions of their problems entertaining and emotionally remote dialectic exercises. (6) It is postulated that partially conscious or unconscious drives and motives are implicit in psychiatric situations, that these remain

relatively constant until altered by therapy; it is this constancy that is reflected in large reliability coefficients rather than the topical validity of the test content; the injunction to be "absolutely frank in answering these questions" is academic naïveté. On the positive side, such measurements might serve to advantage, when administered to large groups, by indicating those extremes in need of individual attention.

Personality Measurement from the Standpoint of a Psychoanalyst. G. V. HAMILTON, Santa Barbara.

From a psychoanalytic standpoint personality is a system of interacting dynamisms which are conceived in terms of direct experience. In this sense it is not directly measurable. The component dynamisms are ego habits which are developed in reaction to primary impulses. These habits are modes of organic function which effect control and redirection of such impulses. Their expression in behavior is measurable. In this sense personality is indirectly measurable. Two general methods of approach to the research problem involved are defined.

The Present Status of Personality Measurement. LEWIS M. TERMAN, Stanford University.

The measurement of personality is bound up with the question of psychological measurement in general. The writer holds that at present psychological measurement is possible only in a loose sense. In the field of intelligence attempts to derive equal point scales and absolute zeros have led to bizarre results. Have such expressions as "twice as much intelligence" any real psychological meaning?

Surely we are no better off in the field of personality testing. We are not *measuring* personality, but exploring to see how people respond to tests which are believed to reveal personality differences. The literature of the last fifteen years records many interesting investigations, some of which offer great promise for the future. Future progress demands that more study be made of the psychological significance of the various types of response that are found and of extreme differences in total score.

Aspects of Personality, Physique, and Acid-Base Equilibrium of the Blood. J. A. HAMILTON and N. W. SHOCK, University of California.

The present study attempts to investigate such relationships as may exist between certain aspects of personality, physique, and the

acid-base balance of the blood. Finger blood was taken from 137 students and determinations of bicarbonate, partial pressure of carbon-dioxide, and hydrogen ion concentration were made, using the micro-method of Shock and Hastings. Twenty-nine anthropometric measurements were made and morphological indices were calculated. The subjects were given the Northwestern Introversion-Extroversion test, a modified form of the Thurstone Neurotic Inventory, and were rated by two judges. A study of the intercorrelations indicates a small but consistent tendency toward the association of introversion and neurotic instability with respiratory irregularity. The less stable individuals tended to deviate from the norm of carbon-dioxide tension more than the more stable subjects, and these deviations were more likely to be in the direction of an excess of carbon-dioxide.

An Analysis of Bernreuter's Personality Inventory. GEORGE KUZNETS, University of California. (Introduced by R. C. Tryon.)

The Bernreuter Personality Inventory was found to consist almost wholly of items that were evidently taken from tests used in validating the Inventory. The number of common items ranged from 50 with the Thurstone Neurotic Inventory to 31 with the Allport A-S Reaction Study. The common items were found to determine over 70 per cent of the variance of the total scores on the neurotic tendency and the self-sufficiency scales, and on the average 40 per cent of the variance of the total on the introversion-extroversion and the ascendance-submission scales of the Inventory. These findings indicate that the high validity coefficients obtained by Bernreuter are to a large degree spurious.

The Constancy and Generality of Emotional Adjustment in Adolescents as Measured by a Questionnaire. CAROLINE MCCANN TRYON, University of California.

A 250-item questionnaire concerned with emotional adjustment was given to 300 public school children twice at a year's interval when the children were eleven and twelve years old, respectively. The inventory was scored for eight categories of emotional adjustment. Analysis suggests that a child may be consistent at a given time in reporting adjustment in each of the several categories, and that he tends to persist in his reports after a year, but that his degree of adjustment in one category will have very little agreement with his degree of adjustment in another. The eight inventory domains

were correlated with two sets of observers' opinions: (1) classmates' (twenty items) and (2) adults' (seven items). The distributions of these correlations were compared with and found similar to distributions of truly zero *r's* varying by sampling errors only. Conclusion: Self-report of adjustment, though independent of observations by a second person, is a legitimate domain of investigation, manifesting consistent and constant individual differences.

A Comparison of the Physiological Responses of Adolescents to "Diagnostic" and "Non-diagnostic" Test Items from the Tryon Personality Inventory. N. W. SHOCK and CAROLINE MCC. TRYON, University of California.

The aim of this study is to determine the degree of association between the extent of physiological changes and the response made to selected items from the Tryon Personality Inventory. Blood pressure, pulse rate, respiration rate and volume and apparent electrical resistance of both hand and foot were recorded simultaneously on photographic paper while the subjects were asked to respond by "yes" or "no" to 40 selected items from the Inventory. Eighty adolescent boys and girls were tested. Preliminary results indicate that on the average, greater changes in the apparent skin resistance follow "diagnostic" than "non-diagnostic" responses, but that certain items show individual discrepancies which lead us to suppose that some of the so-called "non-diagnostic" responses may have considerable emotional value for individual cases.

A Genetic Study of the Bernreuter Inventory and the Peterson War Scale. PAUL R. FARNSWORTH, Stanford University.

Four hundred eleven Stanford freshmen were tested in the autumn of 1932. One quarter were retested in 1933, another will be retested in 1934, still another in 1935, and the last in 1936. The 1933 data show that there was no significant mean change in war attitude, but that during the year the subjects had become more dominant and less neurotic. Retest correlations and changes in terms of sigma scores have been figured.

A Personality (Bernreuter) Study of Two Groups of Psychotics. POE ENG YU, University of California. (Introduced by O. L. Bridgman.)

One hundred and sixty-one patients (127 dementia praecox, and 34 manic-depressives) from the State Hospital at Stockton were given the Bernreuter Personality Inventory. The results are sum-

marized as follows: (1) The Bernreuter Personality Inventory differentiates a group of manic-depressive and dementia praecox patients slightly but not sufficiently to warrant its use as a diagnostic tool. (2) Dementia praecox patients show a greater tendency toward introversion, neuroticism and submission than do manic-depressives. (3) Sex differences in manic-depressives and dementia praecox are not invariably present. (4) Six of the 125 test items of the Inventory differentiate the manic-depressives and the dementia praecox groups. These six items are not specific for a single group, nor are they of sufficient likeness to warrant grouping them together. (5) "Normal" individuals (Bernreuter's) differ from both manic-depressives and dementia praecox in being less submissive, less neurotic, less introverted and more self-sufficient.

The Relationship Between Adolescents' Interests and Other Social Measures. VARDEN FULLER, University of California. (Introduced by M. C. Jones.)

From an interest questionnaire prepared by Dr. Mary C. Jones, adolescent boy and girl interests in things to own, things to do, magazines to read, places to go, and what to be when grown up are analyzed; selected items show significant relationship to such other variables as intelligence test scores, psychologists' ratings of social prestige and physical attractiveness, and to the child's popularity in terms of classmates' estimates. Alternative interpretations are possible to account for the relationship between intelligence and interests; whatever the initial cause of relationship, the tendency of the children of different intelligence levels to respond selectively to their environments may be regarded as a developmental factor of some consequence. Similarly the rôle of interests is significant in relation to a child's social standing; differences in prestige and attractiveness tend to be accompanied by interests of a symptomatic and often compensating type.

Measurement of Student Adjustments. HUGH M. BELL, Chico State Teachers College.

The Adjustment Inventory has been constructed as a diagnostic measure of adjustment problems of students of high school and college ages. Four separate measures of personal and social adjustment are provided: Home adjustment, Health adjustment, Social adjustment, and Emotional adjustment. Each item in the Inventory has been analyzed to determine its diagnostic significance. Coefficients of reliability were determined by correlating the odd-even items and

applying the Spearman-Brown prophecy formula. The subjects were two hundred fifty-eight college freshmen and juniors. The coefficients are as follows: Home adjustment, .89; Social adjustment, .89; Health adjustment, .80; and Emotional adjustment, .85. The reliability of the total score is .93. The Inventory has been validated through the selection of "Very well" and "Very poorly" adjusted groups of students by counselors in high schools and colleges. When the mean differences were compared with their respective sigmas, the following critical ratios resulted: Home adjustment, 7.02; Health adjustment, 6.58; Social adjustment, 5.52; Emotional adjustment, 5.32.

Psychological Factors in Maladjusted Marriages: An Analysis of Two Thousand Consecutive Clients. D. P. WILSON, Los Angeles.

The Institute of Family Relations was founded by Dr. Paul Popenoe to deal primarily with marriage problems. Its scope is three-fold: Personal Consultations, Research, and Public Education in Marital Adjustment. In nearly five years it has served ten thousand clients. From this experience with both successful and failure marriages, it is able to conduct large pre-marital advisory and lecture service to schools and colleges, as well as to the general public. While admitting that many of the usual factors such as lack of preparation for marriage, ignorance of sex and its marital technique, lack of common interests, and differences in basic attitudes cause many difficulties, yet personality problems and maladjustments have a high frequency even in routine cases. We are forced to posit certain traits of male-ness and female-ness as a personality consideration, in addition to situations of frigidity, ejaculatio-praecox, dominance, emotional instability and immaturity as a matter of routine. An analysis and follow-up of the first two thousand clients, both divorced and rehabilitated, gives valuable mathematical and psychological insight as to cause, prevention, and frequency of complications, as well as to type of therapeutics best suited.

Delinquency Areas in San Jose. RUTH T. WILSON, Stanford University. (Introduced by M. A. Merrill.)

An investigation was made of the geographic distribution of the homes of San Jose boys who appeared in juvenile court during the five-year period 1928–1932. The proportion of delinquents to juvenile male population was found to be highest in the industrial areas, median in the commercial areas, and lowest in the residential areas. In an attempt to differentiate the characteristics of the several areas, the incidence of such factors as foreign-born parents, density of

juvenile population and recidivism were investigated in relation to the delinquency rate of those areas. Thus intercorrelations were computed between the rank orders of the frequency of occurrence of ten factors in each of the areas. Evidence from this analysis leads to the conclusion that areas of high and low delinquency rates cannot be differentiated one from another on the basis of any of the factors considered.

A Study of Errors in Learning. HAROLD D. CARTER, University of California.

Words selected on the basis of preliminary data as pleasant and unpleasant are being used as material in a paired associates learning task. The task is to give the word in response to a picture of a person. The subjects are sixth and seventh grade children, who are being tested with new selections of words at six-months intervals. Ratings of emotional tone of the words, secured from these children, support the original classifications of the words. Errors made by the subjects consist of failures to respond, and incorrect responses. Tabulation of 4,000 errors shows statistically reliable trends in these results. Failures to respond are more frequent among the unpleasant words. In their false responses, there is a tendency for the children to replace correct unpleasant words with incorrect pleasant ones. Results are consistent with a Freudian interpretation of amnesias and errors in recall.

Monocular and Binocular Letter-Position Scores of Defective Readers in the "Range of Attention" Experiment. ELEROY L. STROMBERG, University of Oregon. (Introduced by Dr. H. R. Crosland.)

Presenting letters of the alphabet tachistiscopically to each eye separately, and to both eyes, the present investigation has sought more specific results in monocular as opposed to binocular vision as accruing from the eye-dominance of defective readers. Myopia, hypermetropia, astigmatism, and muscular imbalance are also measured. In the right visual field no differences appear as between the right, the left, and both eyes; but, in the left and center fields, significantly large differences are present, in the nature of higher average letter-position scores for the right eye and both eyes than for the left eye. Correlations between the left eye and both eyes are higher than between the two separate eyes, or between both eyes and the right eye. This fact, and the oculist's measurements showing muscular imbalance, suggests that there is fundamentally, in most of our defective readers, a condition of left eye-dominance.

The Relative Difficulty of the Choice-Points in a Maze. WARNER BROWN, University of California.

A method is described, using modified Vincent curves, by means of which the progress in learning for each choice-point in a maze can be shown graphically. In the case of a particular life-size human maze it is shown that some choice-points present difficulties which persist until the learning is otherwise nearly completed. There are points at which errors seldom occur and others at which a particular wrong turn is found persistently. The relative difficulty of the responses is determined (1) by their position in the temporal series, considered as units analogous to the successive syllables in a series of nonsense syllables, (2) by the shape of the maze as an object and by the direction of the goal, (3) by the nature of the movements executed, principally forward going and centrifugal swing.

Results of Practice with Two Codes in Substitution. J. E. COOVER, Stanford University.

A total of 4,776 substitutions of Dearborn symbols for Digits produced a rate of 75 per min.; 4,586 Shorthand symbols, 52. Causes of inhibition and facilitation introduced were: (a) Changing codes, (b) Reversing association, (c) Special practice. Interposing 1,212 Shorthand substitutions reduced Dearborn from 65 to 36; 1,016 Dearborn substitutions reduced Shorthand from 44 to 33. This inhibition was quickly succeeded by a facilitation to a new high rate. Special practice on the reverse association raised Dearborn from a plateau of 71 to 92. Interference in alternating codes in the same work-period amounted to 0.314 sec. per alternation. Cognizing Shorthand, Dearborn and Digits required 0.755, 0.462, 0.343 sec. Dearborn is 75 per cent, Shorthand 32 per cent, toward the automatization of Digits; Shorthand takes 64 per cent more time. The direct association Digit-Dearborn requires 18 per cent more time than the reverse, in which the best known member occupies second place. Analysis of part-processes demonstrates overlapping.

The Effects of Practice Upon Inter-Correlations Between Motor Skills: a Critical Experiment on the Importance of Physiological Limits. CLAUDE E. BUXTON and LLOYD G. HUMPHREYS, University of Oregon. (Introduced by Robert H. Seashore.)

Previous findings of low inter-correlations between fine high speed motor coördinations have been challenged since testing periods were not sufficiently long to allow reaching physiological limits, and were therefore not critical to the theory of a general motor ability.

As a crucial experiment, two tapping tests which are uncorrelated on initial measurements were selected for intensive practice. Since they are similar and what little improvement occurs is rapid, they should offer the most favorable condition for increasing resemblance. Spool packing and rotary pursuit tests, also known to be initially uncorrelated, were included as a more severe test to determine whether unrelated tests would tend toward equivalent levels of skills after intensive practice. Preliminary experiments showed that three days' practice accounted for practically all of the improvement. Fifty observers are now receiving three days' training and comparison of initial and final inter-correlations should permit an evaluation of the importance of general physiological limits in determining individual differences in fine motor skills.

Effects of Practice Upon Measures of Steadiness. WM. BELTON, JAMES R. BLAIR, and LLOYD G. HUMPHREYS, University of Oregon. (Introduced by Robert H. Seashore.)

Recent studies of rifle marksmanship by Seashore and Adams[1] found that the six members of the University of Oregon rifle team were markedly superior to an unselected group of fifty military students on five steadiness tests. In this experiment three advanced students tested themselves on the same five steadiness tests for ten periods to observe practice effects. The average improvement for all three subjects on the entire battery was merely .4 sigma of distributions from 50 cases. One test measuring serial coördination emphasizing accuracy had a more significant improvement of 1 sigma. Since a direct training period ten times as long as the standard produced so little improvement, it seems doubtful if transferred training from rifle shooting would explain superior steadiness of the rifle team, but it is hoped to test this directly.

An Experimental Analysis of "Motility" as a "Basic Motor Capacity." ROBERT H. SEASHORE and IVAN N. MCCOLLOM, University of Oregon.

Following the discovery that motor tests usually show very little intercorrelation early investigators at Iowa developed the concept of a number of "basic motor capacities" which would determine skill to be achieved in various complex performances. Ream designated a telegraph key tapping test as a measure of "motility," implying that it would be representative of other motor speed tests and

[1] Seashore, R. H., and Adams, R. D. *Science*, New Series, Vol. 78, No. 2022 (Sept. 29, 1933), pages 285–287.

predictive of complex speed functions. Comparison of results from a carefully graded series of simple speed tests including tremor, simple reaction times, numerous simple and complex tapping tests, and more complex motor skills demonstrated (1) non-significant correlations between either or reaction time with any tapping tests, (2) simple tapping tests involving the same movement pattern by different musculatures were closely correlated, (3) a narrow group factor for speed of simple tapping regardless of type of instrument used or direction of movement, (4) another group factor for alternate tapping movements of larger amplitude and moderate accuracy, (5) insignificant correlation between these two narrow group factors, (6) both group factors moderately related to one especially designed to closely resemble both, but no relations to any other of numerous motor and mechanical tests. Such specificity and very narrow group factors do not support the concept of a single basic motor capacity "motility", but indicate the great importance of the pattern of movements in determining degree of skill.

The Objective Formulation of Certain Categories of Annoying Situations. CHARLES M. HARSH, University of California. (Introduced by R. C. Tryon.)

A group of 200 college students gave judgments as to the type of situation involved in each of 630 annoyance items. Later the same group recorded the extent to which they were annoyed by each item and the reason for their annoyance. Group agreement was used as a criterion for the selection of categories or types of annoying situations. High agreement within the group as to the type of situation gave assurance that variations in the reported extent of, and reason for annoyance were indicative of individual differences other than divergent interpretations of the situations. The consistency of a person's disagreement with the group opinion was found by comparing the number of eccentric responses in the two parts of the inventory. These eccentricity scores were correlated with a measure of breadth of acquaintanceship, with social adjustment as measured by sections of the Thurstone Psychoneurotic Inventory, and with the reported reasons for annoyance.

An Analysis of Some Musical Factors Determining the Mood Characteristics of Music. RALPH H. GUNDLACH, University of Washington.

What compositional factors within music fluctuate more or less closely with the characterizing mood of the selection? Forty phrases

from as many selections were judged as to their proper mood by 112 observers who were provided with a data sheet having 17 mood categories listed, and spaces for as many additional as the observer cared to use. The reliabilities of the judgments and of the categories are in general satisfactorily high. It is possible to characterize most of the selections according to some definite mood. The selections were then analyzed according to range, pitch, speed, loudness, types of rhythm and interval, and orchestral range, and the characteristics of each mood, in terms of which musical characteristics were determined. A final analysis of the judgments attempted to establish the interrelationships between the various moods. It is clear enough that certain moods belong in one dimension and others in quite different dimensions.

The Hand, Eye, and Foot Preference of Two Hundred Mentally Subnormal Subjects and Two Hundred Subjects of Normal or Superior Intelligence. CARROLL DART, Claremont Colleges. (Introduced by M. B. Eyre.)

The purpose of this investigation was to compare the relationship with regard to hand, eye, and foot preference of mentally subnormal subjects with that of average or superior intelligence. The degree of cross preference as well as the right and left preference was considered. The test battery included four tests of handedness: throwing a ball, near reaching, energetic reaching, pointing; two tests of footedness: kicking a ball, pushing a ball; and a paper-hole test of eyedness. In the comparison of the two groups: (1) more normal subjects showed a homolateral preference; (2) more mental subnormal subjects prefer an eye which does not correspond to the hand and foot preference; (3) apparently left-handedness is not more prevalent among mental subnormals; (4) the adult population showed a higher degree of correspondence in hand, eye, and foot preference than did the younger children.

Hand, Eye, and Foot Preference of Two Hundred Psychotic Patients and Two Hundred College Students. CONSTANCE M. CHANDLER, Claremont Colleges. (Introduced by M. B. Eyre.)

Two hundred psychotic patients (50 manic-depressive men, 50 manic-depressive women, 50 dementia praecox men, and 50 dementia praecox women) were compared with 200 college students for homolaterality of eye, hand and foot preference. Consistency between the four hand tests and two foot tests was requisite for preference of hand and foot. The results are as follows: More psychotic than

normal individuals prefer a non-corresponding eye with a corresponding hand and foot. More normal women than normal men prefer a non-corresponding eye with a corresponding hand and foot and prefer a non-corresponding hand and eye. No statistically significant differences are revealed for crossed functioning of hand and foot. No statistically significant differences are revealed between the manic-depressive and dementia praecox groups for crossed functioning. More normal than psychotic individuals have a preferred eye, foot, and hand correspondence. No statistically significant sex or diagnostic differences are revealed for hand, eye, and foot preference.

The Reliability of Performance Tests with Adult Subjects. CHARLES J. MARSH, Stanford University. (Introduced by W. R. Miles.)

In the Stanford Maturity Study of 1932 an opportunity arose to investigate how reliably performance tests measure adult ability. Three well known tests were applied to 300 persons ranging in age from twenty-five to eighty-two years. The reliability of the Dearborn Formboard Number Three was estimated by two methods. Averaging the intercorrelations of the three items and applying the Spearman-Brown formula to the result yielded an estimate of .38. Since this was unsatisfactorily low, 36 individuals were given the test twice and the test-retest coefficient calculated. This value was .21. Omitting time scores and using only moves as a criterion, the test-retest correlation is increased to .35 or about 50 per cent. Since both methods yielded estimates too low for meaningful use of the data, the test was dropped. Splitting the Healy Picture Completion Test II into two approximately equal halves, and splitting ten tests of the Porteus Mazes into odds and evens, resulting reliability coefficients are .72 and .78 respectively, after application of the Spearman-Brown formula. Although these values are lower than might be desired, they are large enough to warrant use of the tests with groups.

Relation of Interest to Ability in Terms of Life Insurance Interest Scores and Sales Production. EDWARD K. STRONG, JR., Stanford University.

Successful life insurance agents score higher on the life insurance interest test than men in general and higher than unsuccessful agents. Men with low life insurance interest ratings seldom earn a living in the business. Because of the many factors which contribute to success it is doubtful if the correlations obtained between interest and production (ranging between .10 and .55) are adequate measures of the relationship.

Brightness Discrimination of the Paired and Unpaired Halves of the Retinae. DONALD H. DIETRICH, University of Southern California.

The purpose of this experiment is to compare the efficiency of the right with the left half of each retina and the two right halves of the retina with the two left halves in brightness discrimination, by the use of the psychophysical method of average error. A photometer was constructed for use in the experiment. As a preliminary test thirty undergraduate students were tested three different ways. It was found as a result of the tests, that the nasal half of each retina was consistently as efficient as, or more efficient than, the other half of the retina. When both eyes were used there appeared to be no tendency for the left halves or the right halves of the retinae to be more efficient. The test was given at two different intensities and the results from the two intensities tended to support each other. It was further found that the right halves or the left halves of the retinae together are not more efficient than the right or left half of either retina singly.

Some Characteristics of Time-Measuring Instruments. KNIGHT DUNLAP, Johns Hopkins University.

By the aid of a specially constructed apparatus, detailed analytic measurements were made of the performances of several types of time-markers; Stoelting's A.C. vibrator; Western Electric Message Counters, 5-H and 5-T; Stoelting's make and break counter; and the Cenco Impulse counters; with respect to amperage, voltage and durations of actuating current, and to the mechanical factors. From these measurements, the limitations and operative conditions of the instruments have been determined and checked. The reasons why the message, impulse, and make-and-break counters are unreliable for the counting of contacts on tapping plate and steadiness plate are made clear. Successful use of these instruments in conjunction with sensitive relays is reported. Checks on the Standard Electric Time Co.'s "Electric Stop Watch" reveal negligible constant and variable errors. This instrument is superior to the stop watch in low cost, durability, and applicability, as well as in accuracy.

Characteristics of a number of chronoscopes are discussed. In particular the three possible sources of error in use of the Johns Hopkins Chronoscope are pointed out as: (1) Oil or dirt on the clutch surfaces; (2) misalignment of the motor shaft and hand shaft through wear or maladjustment of bearings; and (3) imbalance of the reaction circuits.

Skill and Associative Learning. EDWIN R. GUTHRIE, University of Washington. (Address of the Retiring President of the Western Psychological Association.)

A Child Guidance Research Plan. JEAN WALKER MACFARLANE, University of California.

A representative sample of infants, whose families were contacted shortly after the birth of the child, was divided into an experimental and a control group on the basis of pairings in regard to certain socio-economic data. The experimental group has been for the past six years subjected to Child Guidance procedure, the control group has received examinations but no guidance. Cumulative data are being obtained on the incidence and persistence of "problems" in both groups. Contemporaneously given histories have been compared to retrospectively given ones. Relationships between behavior and personality traits in the child and many aspects of his physical make-up, mental equipment, and environment are being investigated. Effectiveness of current child guidance procedures is being checked. The significance of these early patterns can be evaluated only when the children are older.

The Consistency of Reports on Developmental Data. MARJORIE K. PYLES and JEAN W. MACFARLANE, University of California.

In a cumulative study being conducted by the Child Guidance Clinic of the Institute of Child Welfare of the University of California, an opportunity was offered to compare mothers' later reports of their children's development with earlier records. Comparisons were made of mothers' reports of their children's early development at the 21-month physical examination, with earlier records taken during the first two years of the children's life. The agreement between the early records and the 21-month reports varies for the different items, there being high agreement for birthweight, fair agreement for age at which the child walked alone, and low agreement for physical condition of mother during pregnancy. No relation was found between mothers' education and the extent of the discrepancies between the 21-month reports and the early records. There is a tendency for the later reports to indicate a greater developmental precocity than was suggested in the early records.

Jungle Children. G. M. STRATTON, University of California.

There is evidence that children have lived either in complete isolation or in association with wild beasts. And after return to

human society they have shown lasting defects in gait, speech, and feeling. Nor is it highly probable that all of these children were feebleminded at birth. Lack of association with adults during a certain critical period of early childhood, it seems likely, produces in some or all normal children marks like those of congenital defect. The evidence seems against the romantic view that a civilized community is a chief obstacle to the development of personality. On the contrary, the higher forms of personality become possible only in and through such a community. By our biological endowment alone, or by this as developed by maturing and learning in an infra-human environment, we remain man-beasts. We become human only by active intercourse in a society of those who already have become human.

Are There Two Species of Twins? STEVENSON SMITH, University of Washington.

Standard scores for height and weight of like sex twins and unlike sex twins show that there is far greater resemblance between the pairs of like sex than between the pairs of unlike sex in height and in weight and in height-weight pattern. The unlike sex pairs show slightly more resemblance in height or weight taken separately than in height-weight pattern. Just the reverse is true of the like sex pairs. These results are what we would expect if monozygotic twins exist among twins of like sex. A formula for differentiating monozygotics from dizygotics is suggested.

The Laws of Emphasis and Effect in Children's Learning. HAROLD E. JONES, University of California.

Three experimental situations were devised to test children's learning under trial and error conditions. The apparatus used included a punch board with electrical indicators of error and success, a stylus slot maze with buzzer contacts in the blind alleys, and a body maze with a similar provision for buzzer signals. In each experiment, half of the errors were accompanied by annoying signals sharply calling attention to the mistake; half of the errors were "simple"; they involved frustration and back tracking, but with no annoying or emphasizing effects. The patterns of simple and emphasized blinds were alternated in rotating groups of subjects. The subjects were junior high school children, from 80 to 150 in number. In each experiment, the effect of supplementary annoying stimulation was shown to be negligible in terms of group averages, and it was concluded that the laws of emphasis and effect are inadequate

in explaining children's trial and error learning in these situations. Individual differences are considered, and other determining factors formulated.

Study of Intelligence Levels of Juvenile Diabetics. H. WEST, A. RICHEY and M. B. EYRE, Claremont Colleges.

This investigation is based upon seventy-six juvenile diabetics who have been tested by the Stanford-Binet, fifty-one of whom have had a retest under similar conditions. Diabetic control is given in terms of insulin requirement, based on glucose intake minus urine sugar. Blood and urine sugars were taken within twenty-four hours of the intelligence tests. The I.Q. of diabetics shows a somewhat higher average than in normal children, although with considerable variation. There are some mentally subnormal juvenile diabetics, but the proportion of mentally superior is greater than among non-diabetics. The change of I.Q. on the retest of fifty-one cases is slightly greater than the average change for non-diabetics. The *trend* of the change is more consistently upward. Improvement in diabetes does not raise I.Q. When diabetic control lapses, the I.Q. tends to remain unchanged, or to improve. The general tendency of the I.Q. is to improve rather than to diminish, regardless of diabetic control.

A Survey of Juvenile Court Cases with a Follow-up Two Years Later. OLGA BRIDGMAN, University of California.

This report represents the first steps in a survey of the San Francisco Juvenile Court cases, in which an effort will be made over a number of years to evaluate the causes which seem to have been effective in the production of delinquency. An attempt is being made to produce a scheme which will be clear enough, so that the probation officers may themselves assemble the data on the cases as they are being handled. Thus far an attempt has been made to evaluate intelligence, personality, and home conditions in relation to the child's success while under the supervision of the court. Tentative conclusions, after a two-year period of observation of 107 unselected cases of boys coming before the court, indicate that (1) boys from good homes, if they chance to become delinquent, almost invariably adjust themselves well in a short time; (2) boys with no noticeable undesirable personality traits are twice as likely to succeed as are those with bad traits; and (3) boys with I.Q.'s of 110 or over are twice as likely to succeed as are those with I.Q.'s below 80.

Some Aspects of Physical Development During Adolescence. HERBERT R. STOLZ, University of California.

The Factor of Degree of Learning in Reminiscence. GRACE O. McGEOCH, Stephens College.

In an experiment designed to test the relationship between age and reminiscence, *i.e.*, improvement in recall after an interval without intervenient formal relearning, no significant differences with respect to reminiscence were found between 50 college students and 50 preschool children. There were, however, significant differences in degree of learning. The present experiment was designed to test the effect of degree of learning upon reminiscence by attempting to equate the degree of learning of the two age levels. Two more equivalent groups of 50 preschool children were used. With both groups the learning time was increased, while with one group the amount of material was decreased also. Neither group approximated the degree of learning attained by the college students, although both groups showed significant increases. There were, however, no significant differences in reminiscence between the three preschool groups. The conclusion that degree of learning is not a factor in reminiscence will be discussed in its bearing upon an explanation of the phenomenon.

Abnormal Totalizing Perception. D. M. PURDY, University of Maine.

This report describes a unique central disorder of visual perception. When the subject fixated a visual pattern continuously, its parts tended to assimilate to one another very rapidly. This assimilation, or tendency towards phenomenal homogeneity, might take several forms: a filling-in of gaps or open areas in visual figures, an apparent movement of parts of a figure towards one another (spatial assimilation), or a complete blurring-away of the figure (assimilation of the total field). These anomalies were strictly dependent on the fact that the subject experienced the visual pattern as a unitary whole, with an abnormal degree of coherence. In time the subject achieved stable perception by developing a more analytic attitude. By alternating between the old and the new attitude, he could then produce the phenomena at will, and cause them to reverse themselves after they had already taken place. It is suggested that the spontaneous "coherence" of visual wholes is a very primitive aspect of perception, in that it is primarily a negative aspect, signifying absence of analysis. We also have indications that the normal stability of the visual field is intimately dependent upon functional processes—upon the processes underlying analytic perception.

The Prediction of Maze Behavior on the Hypothesis of Abstract Spatial Sets in Rats. ROBERT C. TRYON, University of California.

Experiments and analyses reported previously [1] led the writer to the hypothesis that the maze running of rats is controlled by generalized spatial sets and not by directive external cues or by serial conditioned proprioceptive patterns. On the postulation of such abstracted sets, can one *predict* the relative difficulties of blinds of a maze *before* the actual results are seen? This report describes an attempt to predict blind difficulties on the first trial and on the plateau period of the learning of a 20-blind T-maze. The predictions were made before the actual results, based on 140 rats, were analyzed. For the first trial, the r between predicted difficulties and actual difficulties was .73; minor revisions gave .92. For the plateau period the r was .70; minor revisions gave .92. The prediction from the simplified factors of Hull and Spence, namely, exit gradient and food-pointing, gave the much lower r of .38; addition of centrifugal swing gave .44.

Studies in the Sensory Basis of the Maze Habit: I. The Effect of Rotating the Maze. C. H. HONZIK, University of California.

When a 14-blind elevated maze was rotated 180° after a group of *blind* rats had learned it, maze performance was greatly disturbed. Assuming that it was the change in direction of extra-maze sounds following rotation that caused the disturbance, a loud buzzer was used with another group of rats. Disturbance following maze rotation was again found. When, with two other groups, conditions before the rat was put on the maze were controlled by sounding the buzzer before a trial began and by carrying the rats individually the same distance for the two positions of the maze, no disturbance in maze performance was produced by 180° rotations. It was concluded that the change in direction of extra-maze sounds consequent upon maze rotation created a distraction that disturbed maze performance, and that it was necessary to obliterate these sounds both before and during the maze run to prevent disturbance by rotation.

The Experimental Social Behavior of Animals. Ib: The Effect of Early Isolation of White Rats on Their Later Reactions to Other White Rats as Measured by a Second Period of Free Choices. A. G. BAYROFF, University of California.

A previous paper reported the rearing of young white rats in isolation and the results of their choosing between a compartment

[1] PSYCHOL. BULL., 1932, **29**, 545–546; PSYCHOL. BULL., 1933, **30**, 591.

containing food and two white rats and one containing only food. Most of these animals and normal control animals developed marked position preferences which masked any possible social preferences. Approximately four weeks later a similar series of free choices was given, this time between a compartment containing only two white rats and one containing one. The animals were fed 30 minutes later in their cages. It was thought that if the position habits were easy routes to food, then in the no-food period, the position preferences would disappear. As it turned out, they did not and once again no marked social preferences appeared. It is tentatively concluded that isolation does not produce social preferences as measured here. This conclusion awaits further experimentation.

Studies of Abstraction with the Chimpanzee. JOSEPH G. YOSHIOKA, Anthropoid Experiment Station, Yale University.

Four young chimpanzees were given two tests: (1) "oddness" test and (2) temporal choice test. In (1) the animals had to choose one food container out of three, the one differing from the other two in brightness only. After the habit had been established with three cans, WBW (white, black, white) presented in order, the correct choices were not disturbed when the correct can was shifted in position (BWW or WWB), reversed in brightness with incorrect cans (BWB, WBB, or BBW), or changed in brightness (grey in various combination with white and black). The "oddness" of the correct can was learned. In (2) the animals had to choose three white cans in the temporal order of 1, 2, 3 in three consecutive trials repeated five times in a single sitting. After the habit had been established the substitution with three grey or black cans or any combination of grey, white, and black did not disturb the correct choices. The temporal order of 1, 2, 3 was learned. Therefore, it is said that the chimpanzee is capable of "inhaltlich," if not "formale" abstraction.

Specific vs. General Goal Functions in the Maze Running of the Rat. JACK BUEL and E. L. BALLACHEY, University of California. (Introduced by E. C. Tolman.)

A correlational analysis of the error distribution in a 14-unit T-maze for four groups run under different conditions of reward and drive reveal that correlations between the error distribution of the first trial and trials 2–11 range from +.70 to +.83. Intercorrelations between groups for the error distribution of the maze range from +.98 to +.99 for groups run to no reward and groups run to reward. The same relationships hold between hungry and less

hungry groups. These correlations indicate that the relative difficulty of blinds is independent of food orientation and drive. A review of the literature and the results of the error distribution for a maze with and without a heavily weighted factor indicate that goal orientation may be explained as an accident of maze design and the operation of specific factors unrelated to the goal.

The Transfer of the Pattern of Centrifugal Swing Responses from One Maze to Another. E. L. BALLACHEY, University of California. (Introduced by E. C. Tolman.)

Two experiments on the transfer of the pattern of centrifugal swing responses are reported. Experiment I: The rats in group A (the transfer group) were trained on the original learning maze, maze 1, in which the sequence of turns was so arranged that the factor of centrifugal swing tended to cause entrances into the blinds in units 3, 5, 7, and 9. After each animal had met the criterion it was transferred to the test maze, maze 2, which was dissimilar to maze 1 as regards maze-form and the sequence of true-path turns. As in maze 1, however, centrifugal swing produced blind entrances in units 3, 5, 7, and 9. The performance of the experimental group on maze 2 indicates a very great degree of transfer as compared with three control groups. Experiment II: The procedure for Experiment II was identical with that for I. In II, however, in both the original maze and the transfer maze centrifugal swing caused blind entrances in units 3, 6, 8, and 9. The two mazes were otherwise dissimilar. The results obtained indicate a significantly greater amount of transfer in the experimental group than was observed in control groups. From these results, it is suggested that rats can transfer the *pattern* of centrifugal swing responses from one maze situation to another.

Pitch and Time Accuracy of Birds. MILTON METFESSEL and JOSEPH M. BOBBITT, University of Southern California.

The strobophotograph, a device which automatically graphs pitch and time, can measure the elusive patterns of bird singing. A program of studies on bird music includes a quantitative description of (1) songs of different species (ornithology), (2) patterns in the same species graded by professional judges (aesthetics), and (3) comparison of the native and learned song patterns by isolation and control of tonal environment. The particular study to be reported has two aspects: (1) a photographic comparison of the rendition of simple songs by canaries with that of the trainer, and (2) a compari-

son of repeated patterns by the same bird. Both approaches have their advantages in studying the variability of pitch and time in bird singing. For pitch, 80 notes occurring in various repeated patterns showed A.D.'s from the average of equivalent fractional points ranging from .06 to .29 step. For time, 128 notes revealed that the average of the A.D.'s of the compared times scores was .01 seconds.

Subcortical Mechanisms in Learning. I. Description of an Apparatus for Producing Controlled Destruction in the Subcortex. CLARENCE W. BROWN, University of California.

Experimental investigation of the functional significance of subcortical mechanisms in learning has been retarded because of the lack of adequate methods for producing lesions in the deeper nuclei with a minimal destruction of the overlying cortex. The usual surgical methods of destruction by use of the scalpel, by infiltration of chemicals, or by coagulation with the electro-cautery do not allow for a precise control over the locus and the amount of the destruction, and their use for destroying the deeper nuclei always entails the impairment of considerable amounts of the cortex. By means of high frequency currents it is possible to produce controlled lesions in the deeper tissues with an extremely minute destruction of the intervening cortex. A variable control over the voltage and the duration of the current makes it possible to produce lesions varying in size over a wide range.

Subcortical Mechanisms in Learning. II. Description of Problems Used for Testing Learning. EDWIN E. GHISELLI, University of California. (Introduced by C. W. Brown.)

Two important considerations present themselves in any program for testing the learning capacity of operated animals. The first is concerned with the selection of problems which sample a rather wide range of the abilities of the animals to be tested. The second has to do with the reliability of each individual problem. In the present experiment advantage has been taken of the feature of multiple-units, developed by comparative psychologists, in constructing tests for measuring several capacities of the rat. The following apparatuses have been constructed: an eighteen unit multiple-T maze, a four unit brightness discrimination box, a six unit inclined plane box, a twelve unit olfactory discrimination runway, and a twelve unit runway for testing pattern vision. All of these problems have proved sufficiently easy for operated animals to master, yet have been sufficiently difficult to reliably indicate individual differences among

normal rats. With the exception of the brightness discrimination box, each of the problems has given a corrected reliability coefficient above .97.

A Temporal Basis for a Rat's Establishment of Contrary Tactual Discrimination Habits. EDWARD L. ROSE, University of California. (Introduced by E. C. Tolman.)

A rat established two contrary discrimination habits within the same discrimination court. It came to avoid whatever path was marked by a wire-mesh "cue-pad" and to take an *unmarked* path on *its first passage* through the discrimination court, and then *upon reëntering the court* chose the *marked* path in preference to the unmarked path. There is evidence that the rat based these conflicting discriminations principally upon its appreciation of a temporal sequence of "occasions".

Defecation and Urination as Measures of Individual Differences in Emotionality in the Rat. CALVIN HALL, University of California.

That defecation and urination are valid measures of emotional behavior in the rat is supported by the following evidence: (1) they occur in situations recognized to be emotionally arousing in character, *e.g.,* a large unfamiliar open field; (2) they tend to be eliminated with repeated experience in an originally strange situation; (3) as the number of animals defecating and urinating decreases, the number of animals eating in an originally strange situation increases; and (4) these responses are linked with other reactions set off by impulses traveling over the autonomic nervous system. In this report it will be demonstrated that individual differences in defecation and urination are closely related to individual differences in another measure of emotional behavior, failure to eat food in the field situation, when all other factors are controlled. It is concluded that individual rats may be rated for the intensity of emotionality on the basis of differences in the number of days during which defecation and urination are evoked.

The Reliabilities of and Intercorrelations Between Physiological Responses to Different Types of Stimuli. N. W. SHOCK and ADA L. ALLAN, University of California.

This study is designed to investigate further the specificity of physiological responses to various types of stimuli. Changes in blood pressure, pulse rate, respiratory rate and volume and apparent electrical resistance of both hand and foot following various types of stimuli (auditory, visual, tactual, olfactory and ideational) have been

recorded simultaneously on photographic paper for 100 adolescent children. Preliminary analysis of the data indicate that, while the intercorrelations between hand and foot resistance changes and other physiological variables are low for individual stimuli, if average for groups of subjects are used much higher values are obtained. Furthermore, wide individual differences with respect to intercorrelations between physiological variables have been found for different children of our sample. The reliability of changes following stimulation depends on the amount of physiological change induced, the sense modality of the stimulus, the skin resistance level, the temporal interval between stimuli and the position in the stimulus series.

Aspects of Early and Late Pubescence in Man. CALVIN P. STONE and ROGER G. BARKER, Stanford University.

Data respecting the relation of menarcheal age to scores on the Bernreuter Personality Inventory, to physical measurements, and to intelligence test scores are presented for 338 state college women and 258 university women. These women varied in age from sixteen to twenty-four years; their menarcheal ages ranged from ten to seventeen years. Correlational analysis revealed no association between menarcheal age and Bernreuter ratings. Furthermore, the individual items of the questionnaire did not yield responses that differentiated with certainty between women who reached the menarche at eleven years or earlier and those who reached it at the age of fourteen or later. Correlations between intelligence test scores and menarcheal ages were not significant. The possibility of a slight positive relationship between age at first menses and height was indicated by correlation coefficients of $.153 \pm .036$ and $.094 \pm .042$.

An Investigation of Certain Aspects of the Volitional Field in Normal and Subnormal Children of the Same Mental Age. ROBERT C. CHALLMAN, Stanford University. (Introduced by L. M. Terman.)

The purpose of the study was to determine whether or not qualitative and quantitative differences in the volitional field exist between subnormal and normal children of the same mental age, and if they do exist, the extent and nature of the differences. Ninety-six normal and ninety-six subnormal school boys approximately equated on race, socio-economic status, general environment, and M.A. were selected. The normals had a mean I.Q. of approximately 100 and a range of 10 points. The subnormals had a mean I.Q. of 63 and a range from 45 to 75. Six volitional test-situations which involved a "temptation" to do or not to do something were administered individually.

It was found that normal and subnormal boys of the same M.A. act similarly on such things as resisting temptations to neglect a periodic task, to handle a puzzle or a safe before they are supposed to, and to look at pictures instead of performing a set task. The subnormals tend to be superior in resisting the temptation to accept an immediate good of lesser value than a future good of greater value at M.A. 7 and 8 but not at M.A. 9. No functional unity, as indicated by positive intercorrelations between the test situations, could be demonstrated.

Some Useful Adaptations of Apparatus as Time Markers. ALBERT WALTON, Stanford University.

Some brief notes are presented concerning certain inexpensive combinations and adaptations of existing laboratory apparatus in the development of convenient devices for marking off time intervals for presentation registration and control.

The Effect of Auditory Pacing on Reading Speed and Comprehension. W. M. DANNER, JR., Stanford University. (Introduced by Albert Walton and P. R. Farnsworth.)

The auditory pacing method of coaching to improve speed and comprehension in silent reading was originated by the author during 1933. An electrical device paced the reader by rhythmic sound stimuli variable in intensity, pattern and speed to correspond to saccadic movements. In a controlled comparison 30 Stanford freshmen were given 16 half hour individual coaching periods and 8 class sessions on reading and study methods early in 1934. Statistical analysis is not yet complete but average reading rate of many subjects advanced from below 250 words per minute to double or even treble speeds. The paced group gained an average of 33.4 percentiles in comprehension and 40.3 in speed on the modified Iowa Silent Reading Test. Their equated controls, coached but unpaced, gained 35.5 percentiles in comprehension, 30.7 in speed. College grades and other measures indicate improved comprehension for both groups. Appreciably greater gains in speed accompany auditory pacing than traditional methods alone.

The Relation of Age of Human Adults to Some Aspects of the Ability to Do Fatiguing Muscular Work. Age Range: Twenty-five to Ninety Years. ROGER G. BARKER, Stanford University. (Introduced by W. R. Miles.)

Data are presented from 366 men and 328 women. The mean of the distribution of ages is 47.5 years, the standard deviation, 14.5

years. Working efficiency is measured in terms of the time required to complete a constant amount of work. The work tests include (1) prehensile activity involved in grasping a sphygmomanometer bulb in the palm of the hand, (2) prehensile activity involved in "pinching" a sphygmomanometer bulb between the thumb and first finger, and (3) forearm rotation action involved in turning a screw driver. The results indicate (1) working efficiency, as here measured, declines with advancing age, (2) mean efficiency scores may be represented by a straight line for the age span of twenty-five to seventy-nine years, (3) age-efficiency score correlations range from −.014 to −.425 (average −.260), and (4) decline in working efficiency with advancing age is greatest before the onset of fatigue.

Differential Pitch Threshold for Damped Tones. FRANKLIN HENRY, University of California. (Introduced by C. W. Brown.)

Pitch sensibility for sustained tones has received considerable experimental investigation. Apparently no study has been made of discrimination in the case of damped sounds. It is true that a few experimenters have used such apparatus as the Konig cylinders, which produce damped tones, but the damped nature of these sounds has not received specific attention.

The present study is concerned with the rôle of "damping" in tonal discriminations. Data are at hand concerning the relationship between damping and the differential pitch threshold. The thresholds for absolute and differential intensity, and differential damping, are being studied. The results are found to be considerably influenced by the method of threshold determination and the amount of training given the subjects.

The minimum perceptible difference in pitch is found to vary from approximately 0.3 per cent for sustained tones, to 3 per cent in the case of tones having a damping constant of 300. The absolute threshold of audibility is also observed to change considerably as the damping of the tone is altered.

The Value of Space in Advertising. LEONARD W. FERGUSON, Stanford University. (Introduced by E. K. Strong, Jr.)

A review of the literature on the advertising value of space yielded twenty-two sets of experimental ratios concerning this problem. These ratios were based on the experiments of seven investigators and covered a wide variety of magazines, newspapers, and experiments. An average set of ratios was computed which indicates that the value of the size of an advertisement, other factors remain-

ing constant, increases approximately as the square root of the area plus a constant. (Determined empirically, this constant was found to be .30.)

The Incidence and Persistence of Behavior Problems in a Normal Sample of Preschool Children. HERBERT S. CONRAD and JEAN WALKER MACFARLANE, University of California.

The Child Guidance Clinic of the Institute of Child Welfare, under the direction of Dr. J. W. Macfarlane, is making a cumulative study of the behavior problems of over 200 unselected cases. Half of these cases are segregated into a "Guidance Group," the other half into a "Control Group." The Guidance Group receives clinical guidance; the Control Group does not. Each child of both groups has been studied since the age of twenty-one months; the data of the present report are limited to the age period of twenty-one to thirty-six months.

Statistical analysis reveals large differences, both with regard to problems and children. The apparent effect of guidance, as shown by differences in problem-incidence in the Guidance and the Control Groups, is small but favorable. Guidance seems especially effective in the case of such definitely psychological problems as fears and temper tantrums.

Some Comparisons Between Growth in Motor and in Mental Abilities in Young Children. NANCY BAYLEY, University of California.

An infant scale of motor development composed of 74 items was standardized on a group of infants who were given mental tests at the same time. These infants (61 in all) were tested repeatedly at regular intervals from birth to thirty-six months. Reliabilities obtained by the split-half method are fair, though not as high as the reliabilities of the longer mental test. A growth curve, constructed by the Thurstone method of absolute scaling, shows gross motor coördinations to mature more rapidly than mental functions during the first two years, while after this age motor progress is comparatively slower. There is less consistency between scores made by the same child at different age levels than was found for the mental test series. Correlations are of the order of .50 between mental and motor scores during the first fifteen months, and very low, though positive, after this age. There is no relation between scores on the motor tests and the parents' education.

Motion Pictures of Infant Tests. INSTITUTE OF CHILD WELFARE, University of California.

THE FOURTEENTH CONGRESS OF THE DEUTSCHE GESELLSCHAFT FÜR PSYCHOLOGIE

L. D. HARTSON, OBERLIN COLLEGE

The program of the biennial meeting of the German psychologists, held in Tübingen, May 22–26, 1934, voiced the wish of the executive committee that German psychologists offer their services to the National Socialistic government. In his keynote address, President Krueger (Leipzig) discussed the theme: *Die Psychologie des Gemeinschaftslebens.* He called upon psychologists to stake their fortunes on the belief-inspiring objective of a new folk-structure. The crises of recent years resulted in a struggle of class against class which eventuated in a breach; but thanks to the sound will-to-live which has animated Germany, the people have again become conscious of the unifying powers of *"des Blutes, des Bodens und des Geistes"*. Nietzsche realized the methodological difficulties involved in reconstructing a society, but his solution confused folk with mob, power with animal brutality, higher humanity with an exorbitantly evaluated aesthetic intellectuality, and glorified the unattached individual, alienated from the state. Recent history has forced the *"Ich-Du"* problem into the foreground, whereas clear thought concerning the *"Wir,"* its membership, classes and genetic presuppositions has been lacking. Well grounded teaching concerning the *"seelischer Ganzheit"* and the structural relationships of human activities is to be built up in the direction of the *"Ueberindividuelle"*. That which the blood-tie unites and organizes bears a necessarily strained relationship to the voluntary alliance, to comradeship and leadership. Science must study more carefully than hitherto the originative and creative power inherent in the social organization of young manhood. Psychology must amplify the contemporary philosophy of the *Gemeinschaft* but she will be able to do this only as psychologists themselves live in the *Gemeinschaft* and build it.

There were 71 papers on the program, but not more than half a dozen were the product of laboratory research. Klemm (Leipzig) demonstrated a method for facilitating the perception of differences in optical Gestalten, with special application to the discrimination of the racial peculiarities of the human countenance. Pauli (München)

reported the improvement in achievement in uninterrupted addition of numbers when subjects are instructed in advance as to the duration of the task. Schole (Göttingen) reported that after systematic training in listening to the tones at the upper and lower limits of the audible range, it became possible to experience musical Gestalten in the regions beyond the range ordinarily utilized. Wellek (Leipzig) has differentiated two musical types by means of auditory tests, on the basis of the forms of error subjects make in judging musical intervals, harmonies and pitch. One type tends toward the contrapunctal, the other toward sensitivity to harmony. He finds the contrapunctal predominantly in Northern Germany and the harmony type dominantly in Southern Germany and Austria. Giese (Stuttgart) was allotted an hour for his paper on *Lebensleistung und Lebensraum*. The influence of *Raum* was considered under four headings. (1) The geographical situation. Of special interest was his reference to the attitudes of Germans living on the border or beyond the former frontiers. (2) Habitation. He reported the results of psychological tests which indicate that the small city and open country are more favorable to *Lebensleistung* than is the large city. He stressed the importance of such factors as unemployment and housing-shortage. (3) In considering the influence of Kinship he mentioned such factors as the number of children, vocation, the broken home and cultural level. He has found achievement to be below the norm in the *unruhig* vocations, such as that of tavern-keeper, whereas the parish-house is the source of the finest product. (4) Status, the fourth factor, binds the achievement of the individual with that of one's school antecedents, family and workshop.

The bulk of the program was confined to Social Psychology. As is customary in such conventions, a number of *Sammelreferaten* were presented at the general sessions. The first was by Kroh (Tübingen) on Questions of Psychological Inheritance, with special reference to Social Psychology. He said that, correctly interpreted, the facts of biological inheritance clarify the more essential facts of social psychology; indeed that the portentous submergence of the individual in the community and the likelihood of persistence of the natural *Gemeinschaftsfor,* in contrast to the transitoriness of the individual, could scarcely be shown more significantly than they are indicated by the facts of biological heredity. Jaensch's (Marburg) *Sammelreferat* aroused much interest and comment. He discussed *Gemeinschaftsbildung und Staatsauffassung* from the Viewpoint of the Investigation of Types. As contrasted with the former bipartite

culture of the *Unterlebendigen* (that materialistic concept of society which is the basis of the profits-system) and of the *Ueberlebendigen* (transcendental idealism), there is now emerging a culture of the *Lebendigen,* in the foundation of which the German spirit is playing a pioneer rôle. Toennies recognized two forms of social organization, *Gemeinschaft* and *Gesellschaft,* but he did not realize that they were associated with two types of men. The S type (the Synthetic) is endowed only with the capacities which result in the dissolution and disintegration of its social structures; its talents lead to the building of *Gesellschaften.* It is found most frequently in individuals with tendencies toward the *lytisch* diseases (tuberculosis, schizophrenia, etc.) and in the heterogeneously mixed races. The S man is egocentric, he is dominated by anxiety, which continually gives rise to measures for his own personal safety. One of its sub-forms, S_2, creates compensations in the form of a rational superstructure, which counterfeits a true *Gemeinschaftsleben.* It is the S_2 man who, in all social movements, is the hundred percenter. Because the social concepts held by men of the S type are so deeply rooted in their biological constitution, little change in their character may be expected to result from educational efforts; the only effective way of dealing with such men is by *ärtzlichen* measures. Jaensch, who is an enthusiastic supporter of *Nationalsocialismus,* finds such extreme measures necessary because the S type is the *Gegentypus der deutschen Bewegung.* The I (Integrated) type, on the other hand, inclines naturally toward the formation of *Gemeinschaften.* Races are found to be fusions of different sub-forms of S and I men. With the Parisian French S_2 is dominant; the Italians are a union of S_1 and I_1 (that one of the integrated forms which, like the child, finds its values in the objectively visible and tangible). The English are a combination of S_2 and I_3 (that is, of the rationalizing and the strong-willed, integrative tendencies). The requirements of the German movement call for a combination of the dynamic vitality, steadiness, and rationality characteristic of the combination of I_2 and I_3. Art and science, so long as they are under the domination of the S culture are sick and unproductive; they can come to full fruition only when the I elements have unhampered expression.

A group of papers was dedicated to the topic of military leadership and army psychology. Simoneit, the director of psychological testing in the Reichswehr, discussed considerations basic to the selection of men who will be successful, not merely in the army but also in those vocations in which they may be expected to assume positions

of leadership later. Such men cannot be selected by laboratory tests, for the problem is primarily one of judging personality. In such a situation the personality of the tester is more important than his methods. Since the responses which the leader himself will eventually make in his work are a product of the interacting forces of the social task, the environmental situation and the personal attributes of the leader himself, the possibilities of success in selecting leaders is dependent upon the possibility of anticipating the life situations which will be encountered later. The problem is largely one of estimating the candidate's capacity for growth. Metz (Münster) presented the thesis that leadership and *Kameradschaftlichkeit* are not based upon radically different attitudes. In military organization one cannot depend upon the genius type since his performances are not sufficiently reliable. True leadership develops through comradeship (a thesis of the present German Revolution, which contrasts sharply with the Prussian class-organized characteristics of the Hohenzollern days). Nuber (Stuttgart) treated the topic of mental elasticity, which he featured as a characteristic of the leader, both in preparing for and in executing military undertakings. Kreipe (Berlin) discussed the perceptive processes involved in using the instruments of measurement employed in the army; he also reported his attempts to evaluate Jaensch's typological classification in vocational selection. Lucke's (Dresden) paper dealt with the task of training soldiers in the light of the demands for differentiating ranks and concluded that it is more a matter of the spirit than of the intellect.

The remainder of the program is fairly represented by the following topics: Typology and Character (Ach, Göttingen); Race and State (Voegelin, Wien); Development of a Feeling of Nationality through Adolescent Comradeship (Hansen, Münster); Psychology of the Nordic Folk-Character (Jaederholm, Göteborg); Practicability of Appropriating Hardening Methods Employed by Primitive Peoples, Such as the Rejection of the Unfit at Birth or Puberty (Lehmann, Leipzig); Unitary Differential Traits as Fundaments of Hereditary Characterology (Spearman, London).

PROCEEDINGS, FIFTH SPRING MEETING, NEW YORK BRANCH, AMERICAN PSYCHOLOGICAL ASSOCIATION

PAUL S. ACHILLES, SECRETARY

The Fifth Annual Spring Meeting of the New York Branch of the American Psychological Association was held on Saturday, April 7, 1934, at New York University, Washington Square, New York City. It was attended by 314 persons, 146 being members and 168 guests.

The thirty papers presented in the scientific program were arranged by the Program Committee for five sessions as follows: Comparative Psychology, 8 papers; Experimental Psychology, 8 papers; Differential Psychology, 9 papers; Physiological Psychology, 7 papers; Social and Child Psychology, 7 papers. In addition there was a General Session at which the following addresses were delivered:

The Work of Howard Crosby Warren. MARGARET FLOY WASHBURN, Vassar College.

On the Psychology of Thinking. MAX WERTHEIMER, New School for Social Research. Formerly of the Universities of Berlin and Frankfurt.

The Concept of Motivation in Applied Psychology. PAUL F. LAZARSFELD, Psychology Department, University of Vienna, and Director, Institute for Psychological Field Work.

At the annual dinner in the evening, the much regretted absence of the Honorary President, James McKeen Cattell, owing to temporary illness, was compensated for by tributes to him in "An Appreciation of Our Honorary President, J. McKeen Cattell" by Joseph Jastrow, and a characteristically spirited and witty letter from Dr. Cattell himself, read by the Secretary. Following this, Clark L. Hull delivered a notable address under the title "An Adventure in the Experimental Testing of Psychological Theory".

Transactions at the Business meeting following the dinner were briefly as follows:

1. *Secretary-Treasurer's Report:* Read and voted accepted (bank balance, May 31, 1934, close of fiscal year, $386.62).

2. *Elections:* Honorary President, 1934–1937, Joseph Jastrow. To Board of Directors, 1934–1937, Paul S. Achilles and Leonard Carmichael. Secretary-Treasurer, 1934–1937, Herbert W. Rogers.

3. *Committees Appointed: Program*—M. S. Viteles, Chairman; C. J. Warden, C. W. Bray. *Nominating*—C. C. Miles, Chairman; J. W. Dunlap, H. Helson.

4. *Next Meeting:* Invitation to hold next Annual Spring Meeting at Princeton University, voted accepted.

5. *Changes in By-Laws:* Minor changes regarding Committees on Membership and on Local Arrangements, as recommended by the Directors, were adopted.

6. *Publication of Proceedings and Abstracts: Voted* that the Secretary-Treasurer be authorized to defray from the treasury the cost of publication in the PSYCHOLOGICAL BULLETIN of the proceedings and abstracts of papers presented at the Annual Spring Meetings of the Branch.

7. On motion of Dr. Carmichael, cordial thanks to the New York University, to the Program Committee and Committee on Local Arrangements, and to the staff of the Psychology Department of New York University, for their hospitality and efficiency, were voted with appreciative applause.

8. Adjournment—Voted at 10:30 P.M.

Brief abstracts of the papers presented in the scientific program follow:

PROGRAM A

COMPARATIVE PSYCHOLOGY

(8 Papers)

The Process and Mechanism of Ant Learning. T. C. SCHNEIRLA, New York University.

Previous experiments have shown that standard maze pattern 'D' is learned more efficiently when presented as an obstacle to progress of the laden *Formica incerta* ant from food-place to the nest (DL) than it is learned when it opposes passage from nest to food-place (DR). In the experiments now reported, each subject

was made to pass through the pattern under both conditions DR and DL on each of her successive foraging runs. While many ants were able to master the problem in DL, practically all subjects had great difficulty in learning DR, and in the latter case efficiency generally *decreased* after the tenth trip (ca.). The radical difference in the behavior of the same subject during her alternating trips through DR and DL indicates that the characteristic features of the problem were independently effective in the two cases. (Control: Subjects that had learned DR—or DL—were then presented with DL—or DR—and behaved as though it was a new problem,—with minor exceptions.) This segregation of the learned act in dependence upon the particular situation of learning apparently is a central feature in the psychology of insects.

But these subjects performed much more poorly in DR than did ants that were given DR as a separate problem. The reason is not that there was direct interference between the learning of corresponding pattern features in DR and DL (*i.e.*, a form of associative inhibition). Rather, the solution apparently lies in the fact that after encountering the maze obstacle in DL, the ant's motivation for the next trip to the food-box through DR was so reduced that she was unable to cope with the difficult parts of the problem (the blind alleys) in that situation. The ability of representative subjects to run DL efficiently after having made a poor trip through DR evidently had its basis in the nature of the motivation that was brought into play when the subject entered the food-box and acquired food on a given trip. The essential immunity of this maze habit from the effects of experience with the same problem in another situation suggests the dependence of what is learned upon the organic condition of the subject in the training situation.

A Preliminary Description of the Behavior of the White Rat in a Simple Conditioned Response Situation. HAROLD SCHLOSBERG, Brown University.

In this experiment the unconditioned stimulus was a shock, lasting for 165 sigma, delivered near the end of the tail. The conditioned stimulus, a buzz or light, started 335 sigma before the shock and continued until the termination of the shock. The rat was restrained in a holder, and kymographic records were made of the breathing and movements.

During the progress of training certain modifications of behavior appeared. Quite early in the training series the conditioned stimulus

was found to cause a shift in form and rate of breathing. This shift may be described as a preparatory response. After further training the shift was often replaced by a sharp, conditioned inspiration. Finally, tail withdrawal and squeak sometimes became conditioned to the buzz or light. All these responses have been observed in complete form when the shock was omitted, and as early responses appearing before the shock.

The behavior of the rats was extremely variable. Some animals showed the complete response, consisting of inspiration, tail withdrawal, and squeal, after five or ten overlapping presentations of buzz and shock. Others failed to progress beyond the stage of the preparatory response even after a thousand double stimulations. Much of this variation from rat to rat was due to slight variations in the conditioning technique. These were introduced deliberately in an attempt, still incomplete, to isolate the effect of certain factors. However, under substantially the same experimental conditions, the behavior of one rat often differed markedly from that of another.

The results obtained suggest that the conditioned response is one form or aspect of learning, comparable, rather than basic, to other forms.

The Limits of Learning Ability in Rhesus Monkeys. HARRIET A. FJELD, Columbia University.

Seventeen young rhesus monkeys were tested on a task consisting of a series of steps of increasing complexity, the Jenkins Problem Box as standardized at Columbia University being used. This apparatus includes three reaction plates, wired for shock, located in the floor of the main compartment. The task set for the subjects involved the depression of one or more of these plates in a specific order to release the door of the central compartment which contained food. The complexity of the task was increased by adding plates one at a time, each subject being transferred from one step to the next as soon as it reached the required norm of mastery (nine perfect trials out of ten), and advanced from step to step until it failed to learn a given step. At the point of failure, the subject was eliminated from the experiment, and the last step learned was taken as the limit of ability for that animal. The criterion of failure for the earlier steps was 2,000 trials. For later steps either 1,000 active trials or 100 successive failure trials was used. One raisin and a piece of apple of similar size were used as incentives. A strict routine was main-

tained as to the daily schedule and a standardized diet was adhered to. Particular attention was given to taming the subjects and to adjusting them to the apparatus. Distracting stimuli from the experimenter and surrounding environment were excluded to a high degree by means of a one-way light screen surrounding the apparatus, the constant hum of an electric fan, and soundproof doors to the experimental room. Limits were found for fourteen monkeys. The number of steps learned ranged from 2 to 22, with a median of 5 and an average of 7.43. The monkeys were markedly superior to such mammals as the kitten, the white rat and the guinea pig, as tested by others on similar problems in the same type of apparatus. The differences in learning scores from individual to individual and from step to step were very marked. These differences seemed to be due in large measure to differences in specific reaction tendencies of the individuals, to differences in transfer effects and to genuine individual differences in ability to learn. No consistent relationship was found to exist between speed of learning the several steps and the limit of learning finally reached by the individual.

Equivalence and Ambivalence of Stimuli in Chimpanzee. H. W. NISSEN, Yale University.

Two young chimpanzees were trained to choose black when a small black and small white square were presented, and to choose white when the two squares were large. Response was not disturbed when the absolute sizes were varied within limits, and was to black or white according to whether the new size more closely approximated the original small or large size.

In addition to the above-mentioned habits, the subjects simultaneously learned to respond to the larger one of the two black squares, to the smaller of the two white squares. The absolute sizes could be changed without disrupting the relational response.

Simultaneous mastery of the first two habits requires functioning of cues connected with each of the two sizes used; presumably "memory" of the two particular sizes involved is the determining factor. After overtraining on the four habits, employing squares 15 and 12.3 cm. on a side, respectively, similar stimuli but in the sizes 12.3 and 10 cm. were presented. Thus the positive and negative valencies of black and white, respectively, had to be reversed when squares of 12.3 cm. were presented; black which, with this size had been positive, became negative, and white, which had been negative,

became positive. This reversal or transposition was effected with practically no training. When the other three habits were exercised a few times before the stimulus pair, black 12.3 and white 12.3 was presented; reversal on the latter took place without any errors being made. The results, in addition to demonstrating equivalence and ambivalence of a high level of complexity, show that memory for an (approximate) absolute size, or for cues correlated with absolute size, may be acquired in very few trials. The significance of the concept of ambivalence in the field of discriminative behavior is briefly discussed.

The Acuity of the Cat's Discrimination of Visual Form. K. U. SMITH, Brown University.

This paper reports experiments made to determine the extent to which cats may be trained to discriminate visual forms varying in size. In the apparatus employed the animal responds by depressing a small lever below a door upon which a positive stimulus or triangle is displayed. There are two such levers and doors, one set corresponding to the triangle, the other to a circle or negative stimulus. After being released from a restraining cage placed eight feet in front of the apparatus, the animal opens the door related to the triangle by pressing down on the lever with its front paw, and thereby receives food located on a small shelf behind the door. A differential response to a four-inch equilateral triangle and a circle of equal area was established in three animals, with electric shock employed as punishment for a response to the circle. The figures were then reduced in size in a series of tests by presenting in order 3½ in., 3 in., 2½ in., 2 in., 1½ in., 1 in., and ½ in. equilateral triangles with circles equated in area. The animals were not punished by electric shock during the test periods for a response to the negative stimulus.

The three subjects required 300, 400, and 900 trials respectively in order to reach 90 per cent discrimination of the training figures in 40 trials. As the forms were reduced in size the respective subjects failed to discriminate when 1 in., ½ in., and 2 in. triangles were presented on the doors of the apparatus. The responses found were therefore assumed to be a function of the visual stimuli employed, as was also brought out in a series of check experiments made to determine the influence of extraneous factors on the discrimination. The behavior observed confirms the available anatomical evidence that the

cat possesses a highly effective optical system. The results are compared to those secured in similar experiments with other mammals.

Tonal Sensitivity in the White Rat. S. T. BRITT, Yale University.

The purpose of this experiment was to determine whether or not the white rat can be trained to discriminate tone. Although some recent studies have indicated sensitivity to tone, other experiments have seemed to show that the rat can discriminate noise, but does not discriminate pure tone at all.

The conditioned-response method was used in the present experiment, because it has not thus far been employed in the study of tonal sensitivity in the rat, and because it seemed the most satisfactory means of settling the question of tonal sensitivity. The conditioned stimulus, the tone, was produced by a vacuum-tube oscillator, and the unconditioned stimulus was an electric shock on the rat's tail. The response measured was change in respiration, the fluctuations in breathing being recorded photographically. Each animal was confined in a relatively sound- and light-proof structure during the experimental trials.

Three rats were successfully conditioned to a tone of 480 d.v., and three other rats to a tone of approximately 960 d.v. Experimental extinction and spontaneous recovery were demonstrated with all animals. Control experiments were conducted as to purity, intensity, and frequency of tone. The results showed that the animals were definitely responding on the basis of tone.

Tactual Localization in the Rat Fetus. E. T. RANEY and L. CARMICHAEL, Brown University.

Thirty litters of fetal rats of known insemination age were studied in the period between the onset of behavior and birth. The fetal organisms were studied in a bath of physiological salt solution of 37.5° C. in temperature. Placental circulation was maintained.

In general, the results of Swenson and of Angulo y Gonzales on the order of development of behavior in the fetal rat were confirmed. In the present experiment twelve definitely located regions, such as the corner of the mouth and the vibrissal region, were stimulated by a soft hair brush one centimeter in diameter and by a single hair aesthesiometer.

The following conclusions may be presented:

(1) The cephalo-caudal, proximo-distal course of development is in general confirmed, but some exceptions are noted.

(2) No exceptions were found to Preyer's law that the motility of a part is antecedent to receptivity in that part.

(3) The development of response from the "general to the particular" is seen to hold, but many exceptions to this rule appear when development is considered in relation to an established time line.

(4) As development progresses, tactual localization on the part stimulated becomes more specific and the response more rapid. Localizing behavior is indicated by the following types of response: (a) localized response of muscles just below point stimulated; (b) contraction of muscle groups at some distance, so as to move *adiently* or *abiently* the part stimulated in relation to the stimulus; (c) response of fore or hind limb so as to brush part stimulated.

(5) The results shown make possible a reinterpretation of certain factors bearing on the nativist-empiricist controversy in perception.

Early Non-Tropistic Visual Orientation in the White Rat. W. D. TURNER, Bryn Mawr College.

This study is the first of a series made to ascertain the operation of a number of factors in the non-tropistic orientation of 2½–4 weeks old white rats to visual stimuli lying to the right and left of the median plane of the body. This animal counterpart of human perception of visual objects as appearing "to one's right or left" is investigated and measured by means of a circular, white, orientation box the illumination of which leads the rat to escape through a single black door to a dark chamber. Baffles protruding from the wall of the box keep the rat returning after errors to the center of the chamber where visual orientation is made possible. Systematic rotation of the box and dark chamber relative to the illumination, experimenter, and other extra-box stimuli precludes the operation of these factors as orientational cues. Right-left cues from the total situation and the illuminant are reduced to a minimum. Observations made through a one-way screen permit the recording of paths followed by the rat. A camera lucida reduces observational errors to a practical minimum. Accuracy of orientation is stated in terms of the reciprocal of angular distance of oriented wall-contacts from the door. The results indicate that accuracy as so measured remains at a minimum up to the time the eyes open, and then, coincident with the opening of the eyes for the first time, rises sharply to a value closely approximating that of mature orientation. Such effects appear without previous practice in visual orientation. Any comprehensive theory of the mechanisms involved awaits the forthcoming experimental analyses.

PROGRAM B

EXPERIMENTAL PSYCHOLOGY

(8 Papers)

The Influence of Observers' Attitudes on the Perception of Object Color. R. H. HENNEMAN, Columbia University.

The study to be reported is a part of a more comprehensive investigation of the factors underlying the "constancy" of perceived object colors (non-correspondence between the physical illumination and the experienced visual quality of object surfaces). The term "color" is here applied in the special sense to the achromatic (black-white) series of grays. A modification of the usual "brightness constancy" set-up was used in the experiments, the observers being required to make equations of "whiteness" for two disks standing in different illumination; these equations were made under several experimental conditions in which object albedo, general illumination, and field organization were varied. Illumination intensity and brightness of stimulus disks and backgrounds were measured photometrically. Preliminary study revealed that when knowledge of the situation, instructions, and physical set-up were kept standard, observers fell into three groups (no overlapping) on the basis of the amount of "constancy" shown by the equations. Examination indicated that these groupings of judgments of object "whiteness" were due to differences in set or "attitude" on the part of the observers. It was found possible by varying instructions and knowledge of the apparatus, the stimulus situation remaining unchanged, to produce greater shifts in the equations of most observers than could be effected by merely changing the stimulus conditions alone, under constant knowledge and instructions.

A Standardization of the Psychophysical Method of Limits. F. C. THORNE, Columbia University, Long Island University.

The method of limits is particularly adapted to the measurement of all types of thresholds, yet it has fallen into disrepute as a major psychophysical method due to the magnitude of the expectation errors incident to its use. A modification of the method has been devised in which some of the advantages of the Serial Group, Average Error and Constant Stimulus Methods have been included. In a series of control experiments, the absolute threshold to a visual stimulus of variable intensity and constant duration of .1 sigma was measured

using the Serial Group, Constant Stimulus and modified Limits Methods. A qualitative comparison of the data indicates that the Serial Group and Constant Stimulus Methods are only applicable to situations in which the limen remains constant throughout the experimental session, whereas the Method of Limits is suited to all experimental conditions.

Assuming that smaller numbers of relatively reliable threshold determinations are more desirable than large numbers of relatively unreliable datum, a mathematical process has been worked out for determining the reliability of single thresholds as obtained with the Method of Limits. Following this analysis, it has been shown that the Method of Limits is reliable when expectation errors have been diminished by suitable methodological modifications. The suggestion is made that in order to determine the number of cases that need be taken to get reliable data in any experimental situation, the standard error and reliability formulas may be solved for N instead of R, after some estimation of the variability of the distribution has been obtained through preliminary experimentation.

An Experimental Comparison of the Absolute and Constant Stimulus Methods in Gustation. CARL PFAFFMANN, Brown University.

In this study the constant and absolute psychophysical methods are compared with gustatory stimulation. The sensitivity of three subjects to disodium hydrogen phosphate was determined by both methods. With the constant method the molar concentrations of .10, .115, .13, .145, .16, .175, as comparison stimuli and .1375 as standard were used. The stimuli were presented so as presumably to eliminate the time error. The solutions were contained in unmarked drinking glasses. The subject took first a mouthful of one solution and then a mouthful of the second solution and retained each for five seconds. The mouth was rinsed before and after each stimulation. Ten judgments were thus obtained per day for a period of five days per stimulus value. With the absolute method, the same subjects assigned a number value, ranging from 1 to 6; (1—least intense, 6—most intense); to the single stimulations. The average temperature during the entire experiment was 22.7° C. The results were treated by Urban's process. PE was used as a measure of sensitivity rather than L and was based on a two category series of judgments.

The results show that the sensitivity of the three subjects was approximately the same. No progressive practice effects were observed from day to day. The time error is the same order of mag-

nitude but of different direction for the two methods. As in other receptor fields, twenty-five judgments appear to be adequate for the determination of a limen. Comparison of the judgments suggests that the constant method might, as a result of the double stimulation, cause adaptation of the receptor, while no such effect is produced by use of the absolute method. The conclusion is drawn that the absolute method is more adequate for psychological investigation in the field of taste.

Is Cutaneous Warmth Adaptation Affected by Varying Duration and Interval of Stimulation? FLORIEN HEISER, Yale University.

Forty-nine "warm-spots" were stimulated on the foreheads of each of 2 trained Os, using mechanical stimulation at 43° C., 4 grm. pressure, and 1.1 mm. diameter. The methods of stimulation were (1) continuous stimulation; (2) alternation of 6 sec. stimulation and 2 sec. interval; (3) alternation of 4 sec. stimulation and 4 sec. interval.; and (4) alternation of 2 sec. stimulation and 6 sec. interval. Each method was continued 40 sec. after the last cessation of warm sensation as in several cases the sensation would disappear and return after a few seconds. A spot was regarded as adapted if the warm sensation disappeared and did not return in 40 sec.

Adaptation time was regarded as the total time of actual stimulation during which warmth was felt. Because of the great variability between spots the median adaptation times were compared. For observer M the median adaptation times were 51, 42, 36, and 28 sec. and for observer H they were 40, 36, 28, and 16 sec. for the four methods respectively. In all comparisons the critical ratios were significant.

Although adaptation time is seen to vary directly with the duration of separate stimulations, it varies indirectly with the number of stimulations and the total time involved in adaptation under the different methods. The median number of stimulations for the four methods respectively were 1, 7, 9, and 14 for M and 1, 6, 7, and 8 for H. The median total time involved in adaptation for the four methods respectively were 51, 56, 72, and 112 sec. for M and 40, 48, 56, and 64 sec. for H.

If adaptation is due to the reaching of a new equilibrium in the temperature of the sense-organ, the shorter the stimulus duration and the longer the interval, the greater is the number of stimulations and the total amount of time required to bring about the new equilibrium.

Anticipatory Behavior in the Execution of a Simple Sensory-Motor Coördination Task. S. B. LINDLEY, Yale University.

Anticipatory behavior was found to be a prominent feature of the reactions made by normal subjects who were under instructions to tap on a key in coincidence with a rapid succession of auditory stimuli. In reacting to a rhythmic succession of stimuli most subjects, upon a repetition of the experiment, delayed their initial reactions much more than they did in the first experimental session. Despite this delay their progress through the remaining successive levels of accommodation to the task was more rapid in the repetition of the experiment than it was in the original session. A second manifestation of anticipatory behavior consisted in the fact that practically all of the reactions occurred within the usual latent period of simple reaction times. Also, a large percentage of the reactions actually preceded the stimuli for which they were apparently intended as responses. Individual differences among subjects in regard to degree of anticipatoriness were found to be fairly consistent.

The subjects were untrained and analysis of the systematizations of their reactions brings out at least four successive levels of achievement, each succeeding level being a distinct advance toward an adequate execution of the instructions. The first level of achievement was reached when a subject made at least one tap during the series of stimuli. The second level was reached when a series of reactions were made, regardless of the patterning of the reactions. A third level of advance was marked by the establishment of a rhythm of tapping comparable to the rhythm of stimulation and a fourth level when stimuli and reactions were nearly coincident. Subjects could be ranked on the basis of the level of adequacy of learning which they achieved. Those individuals who progressed through all of the levels were further ranked in accordance with the degree to which their reactions approximated coincidence with the stimuli. The latter rankings were not as reliable as the rankings on the basis of degree of anticipatoriness.

The Relationship Between Amount of Symbolic Rehearsal and Retention of a Maze Habit. R. S. SACKETT, New Jersey College for Women.

The purpose of this investigation was to determine the relationship between retention of a maze habit and varying amounts of symbolic rehearsal. The symbolic rehearsal was in the form of thinking

through the pattern of the maze in the interval between learning and relearning.

Four groups of twenty-five women college students each learned a Miles' finger maze made up of twenty-four culs-de-sac, and relearned it a week later. The groups were closely equated in average learning ability in terms of trials, errors and time, and in age.

The subjects in one group were instructed not to think of the maze pattern during the interval. Those in the other three groups were required to rehearse the pattern by thinking their way through it one, three, or five times each evening, depending upon the group to which they were assigned. They were requested not to draw the pattern nor to make any tracing movements during the rehearsal.

Before relearning, all subjects were closely questioned as to their activities with relation to the maze during the interval of one week. The records of those subjects who reported that they had not obeyed instructions were excluded in computing the results.

The main results, when retention is measured in a number of different ways, are as follows:

1. All of the rehearsal groups show greater retention than does the non-rehearsal group.

2. The larger the number of rehearsals the higher the degree of retention.

3. The smallest number of rehearsals used in the experiment was *relatively* more beneficial to retention than the larger amounts.

A Comparison of Two Methods of Learning an Act Requiring the Simultaneous Use of the Two Hands. L. W. CRAFTS and R. M. ALLEN, New York University.

The object of the experiment was to determine whether an activity requiring the simultaneous use of the two hands could be better learned by practicing it first with each hand separately—the "successive" method—or by practicing it with both hands together from the beginning—the "simultaneous". The activity selected was mirror-drawing; specifically, to trace with both hands simultaneously two identical four-pointed stars within two minutes and with not more than two errors with each hand. The subjects were two groups of twenty college students each. The results were that the successive group was reliably superior according to the criteria of time and errors, and markedly so in number of trials. These findings agree with those of Koch, until the present year the only previous experimenter with this type of problem. They may perhaps be explained

mainly by reference to the novelty and the difficulty of the activities learned. For in such tasks the positive transfer from one hand to the other, which the successive method makes possible, may be great. And furthermore the requirement, in the simultaneous method, of performance with both hands from the very beginning of the practice may be too difficult and too confusing for the subject.

An Analysis of Thinking. P. M. SYMONDS, Teachers College, Columbia University.

A group of students met regularly for several weeks under the direction of the investigator and carried on introspective analyses of the procedures used in working on a wide variety of problems, largely in the social studies. These analyses were organized into nineteen different types of thinking and the main steps taken in the solution of these types carefully noted and recorded. Finally an attempt was made by the investigator to discover the relationships between the different types with a view to finding how one form of thought process is dependent on another. This resulted in the following classification:

A. Fundamental Psychological Processes
B. Concepts
C. Organization of Concepts
D. Judgment
    1. Judgment of fact
    2. Judgment of value
E. Organization of Judgments
F. Syllogistic Reasoning
G. Argument—the Organization of Syllogisms

There appears in this classification four levels corresponding to the fundamental psychological processes, concepts, judgments, and the syllogism. At each level there is a problem of organization as well as the abilities themselves.

This analysis is suggestive in showing more clearly the task of education in developing the power of thought in different subject matters. It also offers a challenge to psychological testing to discover to what extent these processes are related. *A priori* it would seem as though they should be highly related inasmuch as they are cumulative, *i.e.*, any process of a higher order embodies in it processes of a lower order.

PROGRAM C

DIFFERENTIAL PSYCHOLOGY

(9 Papers)

The Uniformity and Variety of Word Associations of Negro Boys and Girls. C. W. MANZER, New York University.

The Kent-Rosanoff Free Association Test was given as a group test to one thousand Negro boys and one thousand Negro girls. Subjects of both sexes were students in junior high schools in Harlem, New York City. Frequency tables of the responses to each of the one hundred words in the test have been prepared for each of the two populations. This paper reports the findings of two comparisons of these frequency tables with the frequency tables of Kent and Rosanoff, based upon the responses of a thousand white adults, and with those of Woodrow and Lowell, based upon the responses of a thousand white children.

1. *Uniformity of Response*—When the frequency of the commonest response to each stimulus word is taken as a measure of uniformity, it is found that both groups of Negro subjects are significantly more uniform than either the Kent and Rosanoff adults or the Woodrow and Lowell children. The Negro girls are significantly more uniform than the Negro boys.

2. *Variety of Response*—When the number of different responses made to each stimulus word is taken as a measure of variety of response, it is found that the Kent and Rosanoff adults have the largest variety of response; these adults are followed in order of decreasing variety of response by the Negro boys, the Woodrow and Lowell children, and the Negro girls. The difference between the mean number of responses of each pair of these four groups is statistically significant, with the exception of that between the white children and the Negro girls.

Some Immigration Methods and Results in Deviates. CLAIRETTE P. ARMSTRONG, Court of Domestic Relations, New York City.

Problem

The thesis here presented is to what extent unselected, indiscriminate immigration has caused the present day problem of deviates, that is, children subnormal intellectually and socially.

Norms for batteries of psychological tests tapping various abilities have been computed by the U. S. Public Health Service on appli-

cants for visas abroad, "not suspected of being mentally defective" and admittedly not representative of the average of their population, namely, a sampling largely of older, unschooled, illiterate women, selected because they "always offer the greatest difficulty in determining the degree of mental capacity". Such standardization is surely too low for an American average and therefore an unreliable medium to assist in diagnosing mental deficiency, as is being done at present.

Dr. Kolb succinctly summarizes the deleterious results of admitting to the United States the intellectually retarded in an account of testing 3,000 immigrants in Europe. "The concept mental deficiency is not broad enough to exclude all persons who for social and eugenic reasons it would be desirable to exclude. . . . A general lowering of intelligence together with a certain amount of delinquency, crime, and institutional support is inevitable where many persons of such low mentality are introduced into the population."

Method

A survey of the nationalities (all for New York City) of the 12,000 children in the New York Children's Court in 1930; of the 631 low-grade defectives in the Children's Hospital at Randall's Island; of the 1,000 disciplinary problems in the Parental and Truant Schools; of the 18,116 dependent children not mentally defective (or physically) or delinquent, cared for by the DPW; and of the 10,000 morons and imbeciles in the ungraded classes.

Results

In New York State in 1930, 27 per cent of all children eight to fifteen years old were second generation American-born white, while the largest proportion in any one of these groups of deviates is about 19 per cent, and generally it is less. The problem of mental deficiency and the subnormal, asocial child is one of American-born children of foreign-born parents. The largest proportion of deviates consistently in all groups, is Italian, who exceed their population rates as do negroes.

Some Results of Performance Tests with a Group of West-African Negro Children. ELAINE F. KINDER, New York; SOLOMON MACHOVER, Bellevue Psychiatric Hospital; H. W. NISSEN, Yale University.

A series of twelve performance tests in current clinical use were administered to fifty native West-African Negro children (Sousous)

whose ages (estimated) were from five to thirteen years. Tests which, as standardized, have an equivalent normative range yielded widely divergent performances when applied to this group of primitive subjects whose cultural and racial background is relatively homogeneous. These differences in test performance were consistent throughout the group and are clearly shown by comparison of the statistical measures for the several tests.

Comparison of tests on which our subjects did well (Cube Imitation Test and Adaptation Board) with those on which they did poorly (Manikin and Feature-Profile, Ship, and Digit Symbol tests of the Army Performance Scale), indicates that the difficulty of the tests for our subjects increased as the content and activities involved are more closely related to the particularized experience of a civilized environment.

Comparisons have been made of the performance of younger and older subjects on the series of tests as a whole and of our data with those from American Negro groups studied by Peterson and Telford and by Klineberg.

Qualitative differences between the performance of younger and older subjects in the Cube Imitation Test and the Designs Test of the Army Scale and differences between the average accuracy rating and the average speed rating on the Healy "A" Test have been studied.

The Predictive Value of Interest Test Items for Achievement in Various School Subjects. J. W. DUNLAP, Fordham University.

An interest test composed of 435 items involving terms drawn from the various fields of academic subject matter was administered to two groups of seventh grade pupils with approximately 140 in each group. The students were required to encircle one of the letters L, I, D, or U, for each item thus indicating whether they liked, were indifferent to, disliked or were unfamiliar with the term.

The items of the test were classified according to the specific field to which they seemed to be most closely related. For example, "fractions" and "denominator" were listed as "arithmetic" items; "ocean" and "Honolulu" as "geography" items, etc. Each item was evaluated for its predictive value by comparison with the scores on the corresponding sub-tests of the New Stanford Achievement Test. Weights were determined for each of the four response categories for each item on the basis of the biserial correlations with the appropriate criterion as these were determined separately for each

group of subjects; the computation of a total of 3,480 biserial r's was necessary. This analysis revealed that certain items had high predictive value for the specific subject matter field from which they were drawn.

Such a test could be greatly shortened without reducing its effectiveness, if it could be shown that items having good predictive value for a specific subject have similar value for predicting success in other academic subjects. The ten best items from each of the fields, arithmetic, geography, grammar, and literature, were therefore selected and subjected to another analysis involving the computation of 480 biserial r's.

It was found that certain items were effective for predicting achievement not only for the specific subject matter field from which they were drawn, but also for one or more of the other subjects. In general, items selected from geography and literature tended to have higher predictive value for success in the other subjects than did the arithmetic and grammar items.

Factors Related to Individual Differences in the Constancy of Expressed Attitudes. R. T. Rock, Jr., Fordham University.

Seven groups of male high school and college students totaling 545 cases marked the Strong Vocational Interest Blank on two occasions separated by intervals of three weeks, one year or three years. One group of 100 boys and 100 girls of high school age marked the Garretson-Symonds Interest Questionnaire on three occasions separated by one interval of three weeks and another interval of one year.

The number of identical responses on the two different occasions to the items of the test was determined for each individual and the percentage which this number was of the total number of his responses was considered as the measure of constancy for the individual. This measure of constancy was found to be the best of several measures which were tried because it was least influenced by the distribution of an individual's choices among the three possible responses on the initial application of the tests. When measured in this way wide variations in the characteristic of constancy were found to exist among the individuals of the various groups.

Constancy of response was studied in relation to such factors as age, sex, school marks, school survival and intelligence. For the group having three applications of the Garretson-Symonds Questionnaire the relation between measures of constancy over the short and over the long intervals was determined. The relationship

between the proportion of Like, Indifferent and Dislike responses of individuals on the initial administration of the test and the constancy of their responses, as shown by a comparison of the two administrations, was also investigated.

An Application of Thurstone's Method of Factor Analysis to Practice Series. RUTH E. PERL, Columbia University.

Thurstone's method of factor analysis was applied to a practice series in an attempt to find a factor pattern which would describe scores made in successive practice periods in a single task. This was done in an effort to find a factor common to all the practice periods plus a factor whose influence would seem to be primarily related to practice proper.

This procedure was repeated for four separate tests, namely, Making Gates, Symbol-Digits, Turkish English Vocabulary, and an Arithmetic test. Twenty trials were given in each task, one trial per day on consecutive days excepting Saturdays and Sundays. The subjects were all the 4B pupils in P.S. 165 in New York City. Only those subjects were included who were present for all the practice periods, making about 60 subjects for each test. Considering the first trial on each test as preliminary practice equivalent to more precise directions, there were 19 remaining trials which furnish the data for this study.

Trials 1, 3, 6, 10, and 19 from each task were selected as representing that practice series as a whole. From the size of the factors and their weights on each of these 5 trials we can find out which trial best represents the series as a whole, how practice influences the factor weights, etc. We can also compare the factor patterns in the practice series of the different tests.

An Analysis of Verbal and Numerical Abilities by the Hotelling and the Simplified Thurstone Methods with an Empirical Evaluation of the Methods. G. M. SMITH, College of the City of New York.

The *purpose* of this study was two-fold: (a) to investigate the cleavage between certain verbal and numerical abilities, and (b) to obtain empirically some idea of the value of two recently-developed tools for factor analysis.[1]

The principal *data* were the intercorrelations from two strictly comparable sets of eight intelligence test variables from the studies

[1] H. Hotelling, Analysis of a Complex of Statistical Variables into Principal Components. *J. Educ. Psychol.*, 1933, and L. L. Thurstone, A Simplified Multiple Factor Method. Univ. of Chicago Bookstore, 1933.

of Schneck [2] and of the present investigator,[3] four variables in each set being essentially verbal and four essentially numerical, and each set of four satisfying the tetrad criterion for the presence of a group factor. In addition were investigated four variables from Kelley's study [4] and a sub-group of four from my own study.[3]

In the two larger sets of variables a *cleavage between the verbal and numerical groups* was clearly indicated by comparing the average r's (expressed in Fisher's z-function units) for the intra-group pairs of variables with the average r's for the cross-group pairs. For Schneck's data Diff./$\sigma_{Diff.}$ equaled 4.6; for my data, 2.7, indicating a much sharper cleavage in the former case. The Hotelling and the Thurstone methods each brought out these cleavages in the second component in terms of opposite signs for the verbal and numerical groups, each indicating the sharper cleavage in the case of Schneck's data; each indicating a larger *common factor* in the case of my data, as judged by a comparison of the first and second components.

These two methods applied to Kelley's four variables brought out, in addition to a verbal-numerical cleavage in the second component, a *speed-power cleavage* in the third component; and, with the other group of four, an *analogies-generalizations cleavage* in the third component. These results tallied with the results of tetrad and directed mean tetrad analysis.

The *individual factor weightings,* as obtained by the Hotelling and the Thurstone methods, show fair agreement in the first component but only a very casual agreement in the second and third components. The relative *total weightings* for the several components appear to be significant, however, in each method.

Predicting Musical Progress. HAZEL M. STANTON, The Psychological Corporation.

The Cumulative Key for the Prognosis of Musical Achievement is further validated by graduation data for five hundred sixty-five entering music degree students in a university music school. The Cumulative Key is a five-fold classification of students in terms of *Safe, Probable, Possible, Doubtful, Discouraged*—a classification which has been established from the first semester achievement of music students registered for the four year courses leading to a music

[2] Schneck. Arch. Psychol.; No. 107, 1929.

[3] Smith. Arch. Psychol.; No. 156, 1933.

[4] Kelley. Crossroads in the Mind of Man. Stanford Univ. Press, 1928, p. 100.

degree or certificate. Each of the five group classifications is differentiated in terms of two letter test combinations. After each student was given a battery of musical capacity tests (talent profile) and a comprehension test, the talent profile estimate and the comprehension test estimate were each interpreted in terms of six letters—A, B, C+, C—, D, E—with A the highest decile. Each student was then designated by the two letter test combinations, such as A,A or B,C+ or C—,A, *et cetera,* where the first letter indicates the musical talent profile estimate and the second letter the comprehension test estimate. Those test combinations which occur in each of the five-fold classifications to form The Cumulative Key are the test combinations of greatest frequencies for those students thus classified.

The value of The Cumulative Key as a predictive aid for high school and college students wishing to concentrate in music has been established from various sources of information for the following groups of university music school students: (1) one entering class of 164 students including all five classified groups, (2) three successive entering classes from which the highest (*Safe*) and the lowest (*Doubtful* and *Discouraged* combined) groups were studied, including eighty-three Safe students and ninety Doubtful-Discouraged (D.D.) students, (3) four successive entering classes of five hundred sixty-five students from which the graduates are studied.

The various sources of information are (1) annual academic survivors, (2) academic mortality, (3) scholarships and honors, (4) participation in scheduled recitals for all instruments and voice, (5) hours and points earned for credit, (6) individual talent profiles, (7) mean, median, mode for each of the seven tests used, (8) the percentages of students graduating in each of the five classified groups.

From these sources of information for various groups of music degree students, The Cumulative Key is now set forth as a valuable guide to be used in predicting musical progress and as an index of the annual status of the musical talent in a school, college, or university.

An Improved General Medium for Demonstration, Experiment, and Test in the Introductory Psychology Course. C. W. GLEASON, Yale University.

Introductory psychology, as actually taught, suffers serious inadequacy in experiment and demonstration, reflected by low student ratings for the course on many campuses. There has been no simple,

inexpensive, inclusive medium for introducing experimental content. The writer offers a specific solution.

The medium adopted is film-strip, which is very cheap, relatively durable, easily duplicated, simple to project, and peculiarly adaptable to color projection, serial exposure, tachistoscopy, etc.

A battery of about twenty film-strips, each timed to a class period, provides the beginning student with a "laboratory" class a week for a semester, with latitude in content. It covers important aspects of each field, *i.e.*, nervous system, learning, attention, perception, memory, imagination, thought, emotion, intelligence, etc., comprising demonstrations, experiments, and tests, as subject-matter demands. The content reflects no single school of psychology; it can fit any course organization. Each unit presents an orderly development of its topic. Instructions, methods for reducing data, discussion questions, etc., are shown on the screen. Each student uses a standard record booklet. General advantages: (1) superior visibility (vital to tachistoscopy, color experiments, serial exposures, etc.), for groups of any size; (2) absolute control over time and sequence of stimuli; (3) standard instructions guaranteed; (4) extreme technical simplicity (one simple portable instrument for all uses); (5) cost, a small fraction of that of usual equipments having comparable range of uses. Special feature: an interspersed series of tests of perceptual acuity, learning ability, attention, memory, imagination, thinking ability, general and social intelligence, etc. (partly new, partly adaptations of popular schedules), which will give the student a well-rounded personal psychograph in terms of deviations from well-established norms.

The first edition of the battery approaches completion, being subjected to class-room tests. After subsequent revision, duplicate batteries will be administered next year, in various courses throughout the country. After further revisions and inclusion of performance norms, the system will be released for general use.

PROGRAM D

PHYSIOLOGICAL PSYCHOLOGY

(7 Papers)

Salivary Conditioning in Adult Human Subjects. G. H. S. RAZRAN, Columbia University.

Salivary conditioning was studied by means of the "cotton" or "absorbent" technique in 10 subjects with whom a total of about 2,000 trials was made. The conditioned stimulus was the sound of

a metronome of 100 beats per minute, while the conditioning stimulus was a piece of mint placed on the tips of the subjects' tongues. The index of conditioning was a statistical comparison of the differences in salivation when the metronome was and was not sounded in the pre- and the post-conditioning series.

The results so far indicate that laboratory conditioning of salivation in adult human subjects: (1) in general lacks the uniformity found in dogs or even in children; (2) training, or an increase in the number of combinations of the conditioned and the conditioning stimulus, may result in the decrement and the disappearance of the C-R; (3) when conditioning is manifested, experimental extinction or unconditioning is comparatively insignificant; (4) the conditioned stimulus may become a negative signal reducing the salivation below the norms for no external stimulus; (5) thinking of the conditioned stimulus may produce reliable changes when the actual administration of the conditioned stimulus has no effect; (6) thought and "will" processes greatly modify the amount of salivation.

The experimenter's interpretation is that "the true course of conditioning is obscured in the conditioning of consciously reportable and consciously controllable responses".

The Effect of an Induced Bilateral Metabolic Gradient in the Cerebral Hemispheres upon Excitability Patterns in Peripheral Nerves in Relation to Right and Left Handedness in the Rat. H. H. JASPER, Bradley Home and Brown University.

The preference of the right or left paw in scratching food from a narrow food box was used to differentiate right-handed, left-handed, and ambidextrous white rats. The chronaxies of flexor and extensor groups of nerves in each of the four limbs was also determined. The pattern of excitability in the eight nerve groups was different for the right-handed rats than for the left-handed rats. If the chronaxie of the right flexor of the anterior paw be taken arbitrarily as 1, a schematic representation of the pattern of excitability relationships in the right-handed rat is as follows:

Ratio of ant. right flexor/extensor=1/2. Left flexor/extensor=2/1
Ratio of post. right flexor/extensor=2/1. Left flexor/extensor=1/2

In the left-handed rat there was a definite tendency to a complete reversal of all of these relationships giving a pattern the mirror image of that for the right-handed rat or:

Ratio of ant. right flexor/extensor=2/1. Left flexor/extensor=1/2
Ratio of post. right flexor/extensor=1/2. Left flexor/extensor=2/1

Definitely right-handed rats and definitely left-handed rats were then subjected to the following experiment: (1) the flexor-extensor excitability of the four paws was first determined with the rat under a very mild quieting dose of ether; (2) one side of the frontal and parietal areas of the cerebral cortex was then exposed under ether anesthesia; (3) decreased temperature or novocaine was used to decrease the metabolic activity of this side as compared with the other; (4) the flexor-extensor excitabilities were taken in this condition; (5) then the novocaine or the cold was removed and the skin replaced over the exposed cortex with some application of heat to aid in restoring the area to normal functioning; (6) the flexor-extensor excitabilities were again taken.

It was found that the pattern of excitabilities thus measured could be completed shifted from that of a right-handed rat to that of a left-handed rat or *vice versa* if the activity of the dominant side of the cortex were decreased. A decreased metabolism on the non-dominant side only served to accentuate the existing dominance pattern of excitability in the peripheral nerves.

The Effects of Extirpation of the Frontal Association in Monkeys upon Complex Adaptive Behavior. C. F. JACOBSEN, Yale University.

Monkeys were trained in two types of behavioral tests: (1) situations in which the essential cues to correct response were present in the animal's immediate sensory experience and could be referred to by the animal while responding, *i.e.,* simple problem boxes, and discrimination of brightness and size of visual patterns; and (2) situations in which the essential cues, wholly or in part, had to be recalled from the animal's past experience, *i.e.,* delayed response and a serial problem box.

Unilateral lesions of the frontal association areas resulted in no impairment of performance in any test. Complete bilateral extirpations did not affect simple problem box or visual discrimination habits, but did result in stereotypy of performance on the serial problem box and complete loss of the ability to delay a response for even a few seconds. Incomplete bilateral lesions resulted in serious reduction in ability to react successfully after long delays although the animal continued to respond correctly if the delays did not exceed a few seconds. Bilateral lesions in the frontal association areas greatly interfered with behavior which was dependent upon recalling recent experience (immediate memory) but did not impair behavioral

adaptations determined by cues present in immediate sensory experience.

With bilateral lesions in the parietal association areas, of approximately equal extent, there was no reduction of the ability to perform the delayed response tests. Similar experiments by Breslau on the postcentral gyrus have given uniformly negative results. It is tentatively suggested that the ability to respond on the basis of "immediate memory" is peculiarly dependent upon the intactness of the frontal association areas. The significance of these experiments for theories of localization of function in the cortex will be considered.

A Further Report on the Effect of Prolonged Sound Stimulation on the Auditory Sensitivity of the Guinea Pig. G. H. HORTON, Princeton University.

Two groups of animals whose auditory sensitivity had been determined by a method employing the conditioned respiratory response were subjected to prolonged and intense acoustical stimulation. One group was exposed to a tone of 1,000~ per second at 125 decibels above normal human threshold, and the other to a tone of 1,500~ per second at 100 decibels. The former group received 110 hours of stimulation at 10 hours a day, and the latter 2,000 hours at the same rate. At the end of the stimulation period, and at intervals of one, two, five, and ten months after the end of this period the sensitivity of the animals was redetermined. A general loss of sensitivity found immediately after the exposure period was still present after the ten months interval.

The Effect of Prolonged Sound Stimulation on the Auditory System of the Cat, as Studied by Auditory Nerve Experiments. E. G. WEVER, C. W. BRAY, G. P. HORTON, Princeton University.

Three cats were stimulated with loud tones for different intervals of time, and their auditory sensitivity was then tested by the auditory nerve method. There was no marked loss of sensitivity that could be correlated with the stimulating frequency. These results are discussed in relation to those obtained by other methods for the study of stimulation deafness.

Evidence from Auditory Fatigue of a Dual Mechanism in Hearing. C. H. PEARCE, Brown University.

It has been suggested by H. Davis, on the basis of studies on action currents in the auditory nerve, that the basilar membrane may vibrate as a whole for tones of pitches up to approximately 1,000

cycles, and selectively for tones above this region. During a program of work on auditory fatigue, the possibility of testing this hypothesis suggested itself. If the ear operates in the manner supposed, the following assumptions are advanced:

(1) If the ear is stimulated extendedly by a tone of low pitch, 500 cycles, for example, the loudness of a subsequent high tone, 1,200 cycles, for example, should be lessened by a greater amount than after extended stimulation by another high tone, 2,500 cycles, for example.

(2) If the effects of two fatiguing tones of high pitch, 2,500 and 1,600 cycles, for example, upon the loudness of a low tone, for example, 500 cycles, are compared, they should not prove to be markedly different.

(3) Of the effects respectively of a high fatiguing tone (1,400) and a low fatiguing tone (250) upon another low tone (800), the low fatiguing tone should have the greater effect.

(4) Two low tones (250, 800) should have about the same effect upon the loudness of a subsequent high tone (1,600).

With seven practised subjects 21 sittings were arranged in which the relative effect of two tones on the loudness of a third was compared. The unfatigued ear was used as standard. Loudness change was measured in percentage of "greater" judgments in fifteen fatigue durations. In any sitting the three tones were an equal distance in decibels above the lower loudness threshold.

In the 21 sittings 18 are interpreted as favoring the stated hypothesis, and 3 as dubious (not negative). Subject to several limitations, the data are interpreted as evidence for a dual mechanism of pitch reception.

The Use of Psychology in the Treatment of Stomach Disorders Which Involve No Discoverable Organic Lesion. M. N. CHAPPELL, Columbia University; J. J. STEFANO, Brooklyn Hospital; J. S. ROGERSON, F. H. PIKE, Columbia University.

In this experiment all of the subjects were examined and diagnosed according to the standard medical practices. All were put on a standard dietary regime and the medication was chiefly gastric mucin.

The subjects were divided into a control group of 21 and an experimental group of 19. The control group received only medical aid. The members of the experimental group were divided into

smaller groups and were given daily psychological attention for six weeks.

The psychological measures involved lectures, a technique of distraction, no discussion, and suggestion.

At the end of three weeks of the experimental period most of the subjects reported loss of subjective symptoms. They were then asked to branch out on their diet. At the end of another three weeks the members of the experimental group were eating most everything they desired. All of the control group had recurrence of symptoms as soon as they attempted to branch out towards a normal diet.

At the end of eight months, those who were well at the end of the six weeks' period reported that they had had recurrence of some of the symptoms. These are reported to be mild and of short duration.

Program E

Social and Child Psychology

(7 Papers)

Duration and Periods of Waking and Sleeping in Infancy. Helen Thompson, Yale University.

Developmental changes in total waking time, number of sleeping periods, and longest waking period, for 107 home-residing infants (624 records) of from four through fifty-six weeks of age, were investigated by parent interview. The change in this aspect of behavior is comparable to the change in physical growth of the same infants during this period. The data suggest certain sex differences. Marked individual variations are found. The average amount of sleep, at every age studied, is much less than that recommended by child care hygienists. The findings are compared with those of other investigators using a similar method and using the methods of direct observation and questionnaire. The study furnishes norms which to date have not been available for this age period but which have value for clinical work.

The Effect of Stopping Supervision of Certain Department of Recreation Play Areas Upon the Delinquency Rates of Older Boys. C. A. Ford and Herman Balen, Temple University.

This problem had its origin in the many statements found in the literature to the effect that supervised playgrounds were very effective devices in cutting down delinquency rates. Because of the financial

difficulties of the municipal government of Philadelphia, it was found expedient to close approximately one-half of all the Department of Recreation playgrounds for three months. Accordingly, an opportunity to test the validity of these statements was presented.

Data were collected from the Crime Prevention Association showing the home address, age, and race of each boy between the ages of sixteen and twenty inclusive arrested within the period from June, 1932, to November, 1932, inclusive. During June, July, and August all playgrounds were supervised, while during September, October, and November approximately half of them were unsupervised. These data were plotted on a city map to show the place of residence with relation to the placement of the play areas. Three groups were then formed—those who lived within eight blocks of areas supervised throughout the period, those who lived within eight blocks of play areas supervised during three months and unsupervised during three months, and a group who lived more than eight blocks from the play areas.

The results were that for both groups living within the eight block areas there was approximately the same decrease in the number of arrests during the period of partial supervision, while there was an increase for the city as a whole and for those living outside the eight block areas. In short, the lack of supervision had no evident effect upon the delinquency rates of the groups of older boys who would be most influenced by them.

Delinquency Areas in New York City. J. B. MALLER, Teachers College, Columbia University.

The paper deals with the rate of delinquency in the 300 health areas or neighborhoods into which the city is divided. All delinquent cases brought before the Children's Court were plotted by area of residence. The number of delinquents coming from each neighborhood was determined. This number was divided by the total number of children of court age (six to fifteen) in the neighborhood.

The rate of delinquency was correlated with several other factors, including the birth rate, death rate, the rate of school progress, and the social economic status of the neighborhood, the density of the population and its national and racial composition.

Marked positive correlations were found between the rate of delinquency and the rate of infant mortality, incidence of diseases, the rate of school retardation and truancy, and density of the population. Negative correlations were found between the rate of delin-

quency and economic conditions, average intelligence of school population, and distance from the down-town section of the city. Striking national and racial differences were revealed.

The results will be presented on lantern slides showing maps, graphs, and regression lines.

A Tentative Scale for Clinical Diagnosis of Psychotic Patients. JOSEPH ZUBIN, New York Psychiatric Institute and Hospital.

The determination of whether a given response to an item in a psychoneurotic inventory is indicative of neurotic tendency is usually made on the basis of *a priori* logical consideration or on the basis of what is psychiatrically symptomatic. An empirical validation of these items proved that the logical scoring of these items is not always substantiated by their ability to differentiate between normal and abnormal groups. On the basis of this empirical analysis a new scale of items is being drawn up which we hope will be of diagnostic value.

Age and Occupational Factors in the Residential Propinquity of Couples Applying for Marriage Licenses. DANIEL HARRIS, Lehigh University.

Problem: A recent survey [1] brought out an interesting frequency distribution of the distances between the residences of couples who applied for marriage licenses over a period of five months in Philadelphia. The present study was intended as a check, in a smaller city, and also to determine whether or not there are age or occupational differences in this tendency toward "residential propinquity".

Method: The records of the marriage license bureau of Lehigh County, Pa., for 1930 were consulted, and the occupations, ages and addresses of all persons resident in Allentown who took out licenses were secured. The distance in blocks, counting 20 blocks to a mile, between the addresses of the individuals comprising each couple resident in Allentown was ascertained from a city map. All distances greater than one mile, within Allentown, were lumped together. Where one member of the couple resided outside of Allentown, it was noted whether the distance was greater or less than 20 miles.

There were 570 couples in all. An aggregate frequency distribution for distance was made, and separate distributions according to occupation and age, based in both cases on the man. The occupational groupings were: (1) unskilled; (2) skilled; (3) clerical; (4) business and professional. The age classifications were:

[1] Bossard, J. H. S. Residential Propinquity as a Factor in Marriage Selection. *Amer. J. Sociol.*, 38, 1932–33, 219–224.

(1) twenty-one and under; (2) twenty-two to thirty-one; (3) thirty-two and over.

Results: The aggregate distribution curve of distance resembles fairly closely that found by the survey previously mentioned.

Suggestive differences showed up upon examining both the age and occupational classifications:

(1) The age group twenty-two to thirty-one showed a smaller percentage (13) marrying within five blocks than either the younger (19) or older (27) age group.

(2) Laborers show the smallest percentage (16) marrying over a mile away, within Allentown. (The others show 24, 29, and 27 per cent.)

(3) In the three successive age groups from youngest to oldest there are progressively larger percentages (4, 12, 16) marrying more than 20 miles away. The difference in this regard between the oldest and the youngest group shows up consistently, moreover, *in each of the four occupational groups taken separately.*

(4) In the occupational classification the percentage marrying over 20 miles away increases steadily as one goes up the occupational hierarchy (unskilled, 5; skilled, 9; clerical, 13; business and professional, 22). The difference in this regard between the first and last classes shows up consistently *in each of the three age groups taken separately.*

It is suggested that intellectual powers of discrimination, experience, facilities available for transportation, and gross amount of physical energy on tap, are possible explanatory factors in these various age and occupational differences.

The Case For and Against Eugenical Sterilization. GLADYS C. SCHWESINGER, American Museum of Natural History.

This paper presents the case for and against eugenical sterilization, which because of its current interest, its constant appearance in the press, its inauguration into the laws of many European and American countries, should be studied by professional groups in whose province it most logically falls: physicians, geneticists, sociologists, psychologists, educators, and legislators.

Distinctions will be drawn between three kinds of sexual sterilization: therapeutic, penal, and eugenical.

The argument for its introduction into statutes will be presented; the relief of suffering to unborn progeny; the relief of burden to oncoming taxpayers; the extent of spread of feeblemindedness and

insanity of hereditary etiology; the rising rate of proportions of defectives in our population with the falling rate of progeny to the superior individuals. The case against eugenical sterilization including some 18 points of view will be presented: it is dangerous; it is not 100 per cent effective; it is cruel; it is unfair discrimination against class; it is unnecessary; it is irrevocable; un-Christian; unpatriotic; will lead to race suicide; greater sex promiscuity; wider spread venereal disease; to a medical and legal, perhaps governmental racket; it is scientifically premature; socially injurious; it will not do what it sets out to do; the problem of normal "carriers", etc. These objections, given one by one, will then be answered in turn. Misconceptions and misunderstandings with respect to the aims, methods, and administration of eugenical sterilizations will be discussed and an attempt made to give the latest scientific contribution from the field of medicine, genetics, and social psychology.

If desired, some statistics gathered largely in the state of California where eugenical sterilization has been practised for some twenty years can be cited or referred to. After-effects—social, individual, medical—can be discussed briefly.

Measurement of the Outlook on the Future. NATHAN ISRAELI, Brooklyn, N. Y.

A preliminary report on a further investigation of reactions to the future. An intensive study by interview method was first made of psychotics. Their outlook on the future was studied by the following methods: method 1, relative concern with the past, present, and future; method 2, prediction of one's own future history, or the method of future autobiography; method 3, prediction of future events.

The outlook of psychotics may be described as either limited, autistic, delusionary, catastrophic, uncertain, futureless, constructive, overbuoyant, or as mixed. It has no definite relation to the type of mental disorder. Not only depressed patients are downcast about the future, nor are all depressed patients downcast about their future. The outlook of an individual patient, however, does correspond generally to the clinical description of that patient by the hospital psychiatrists. As a new and effective method for a clinical study of personality, by psychologists and psychiatrists, the method of relative concern with the future, or the method of future autobiography is recommended.

The psychotic and normal data were rated for (a) strength of

drive towards future goals, and (b) expected possibilities, positive and negative. Short forms were constructed on the basis of the interview data for a measurement of outlook on the future. These forms were applied in group studies of psychotics, outpatients of a mental hospital, Lancashire and Scottish unemployed, university and high school students.

Much of the experimentation with psychotics was later paralleled in a study of gifted children in three different communities, in Scotland, through the courtesy of the Scottish Educational Research Council.

This investigation was conducted in America and in Great Britain during 1932–1933 under a fellowship of the Social Science Research Council.

APPROPRIATIONS FOR GRANTS-IN-AID BY THE NATIONAL RESEARCH COUNCIL

At the May and June meetings of the Committee on Grants-in-Aid of the National Research Council the following grants were made in the field of Anthropology and Psychology:

Clarence W. Brown, professor of psychology, University of California, "the functional relationship between the amount of destruction and the voltage and duration of the current"; Frederica de Laguna, assistant, University Museum, University of Pennsylvania, "an archaeological reconnaissance of the lower Yukon, Alaska"; Eugene A. Golomshtok, research associate, University Museum, University of Pennsylvania, "the Old Stone Age in European Russia and Siberia"; J. C. Boileau Grant, professor of anatomy, University of Toronto, "the physical anthropology of the Athapascan Indians of the Mackenzie River Basin"; Melville J. Herskovits, associate professor of anthropology, Northwestern University, "the motor habits of the negroes of Haiti"; George Herzog, research associate, Institute of Human Relations, Yale University, "interrelation of the poetry, language and music of the Pima Indians of Arizona"; Edmund Jacobson, assistant professor of physiology, University of Chicago, "the influence of neuromuscular relaxation on blood-pressure, and action-potentials in peripheral nerves"; George Kreezer, research associate, The Training School at Vineland, New Jersey, "the coördination of antagonistic muscle groups in spasticity"; R. H. Stetson, professor of psychology, Oberlin College, "acoustic and physiological analysis of the vowel as it occurs in actual speech"; Michael J. Zigler, associate professor of psychology, Wellesley College, "the relationship between qualitative changes in cutaneous sensations and their physiological correlates in human nerve".

The National Research Council will be ready to consider further requests for research grants in the fall. Applications should be filed on blanks which will be furnished by the Secretary of the Committee on Grants-in-Aid on request, and should be filed with the Committee before October 15, 1934. Action upon these applications will be taken toward the end of December.